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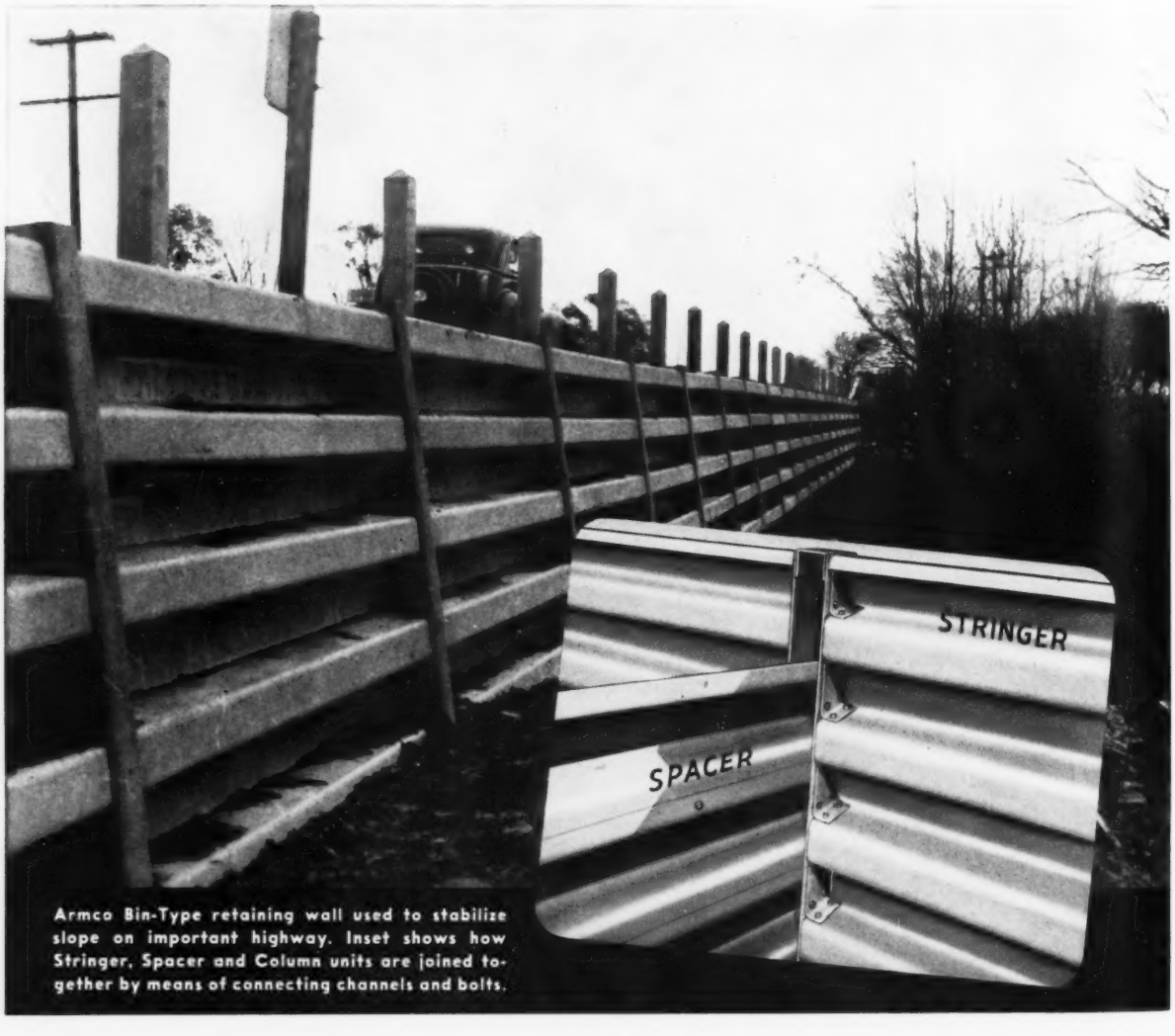
NOW...Even Greater Economy In Retaining Wall Design



Armco Bin-Type retaining wall used to stabilize slope on important highway. Inset shows how Stringer, Spacer and Column units are joined together by means of connecting channels and bolts.

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ARMCO BIN-TYPE RETAINING WALLS

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· ENGINEERING NEWS-RECORD ·

McGRAW-HILL PUBLISHING COMPANY, INC.
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VOL. 120 *FEBRUARY 24, 1938* No. 8

THIS WEEK AND NEXT

THE first state-wide highway building program ever carried out by Mississippi was inaugurated less than two years ago. Progress, despite difficulties inherent in setting up a big organization on short notice, has been excellent. Accomplishments to the end of 1937 when all work was either completed or under contract is reported in this issue.

No one is better qualified to write an obituary about the recently-destroyed Niagara Falls arch bridge than Richard S. Buck, who was construction engineer on the job forty years ago. In "Niagara Arch Memories" on page 297 Major Buck recalls history of bridge at the site, and tells of the problems in designing and building what was at that time the longest steel arch in the world.

Elementary beach erosion studies using small tanks have been so satisfactory at the U. S. Beach Erosion Board laboratory that a larger tank has been built for more elaborate investigations. In one article, Col. Earl I. Brown tells of the organization of the board and the results of early studies. This article is followed by one which describes the new larger tank, built at the Dalecarlia water supply reservation in Washington, D. C.

Interesting comment on what is being done in obtaining salvage from sewage in England is given by J. H. Garner. This supplements comment on the subject previously published in these pages.

The Swiss Society of Engineers and Architects celebrated its centenary last fall. In this issue A. J. Buhler reviews the 100 years of activity of that organization.

NEXT WEEK, C. B. McCullough, assistant state highway engineer of Oregon, discusses the fundamentals that must be considered in planning highway extensions.

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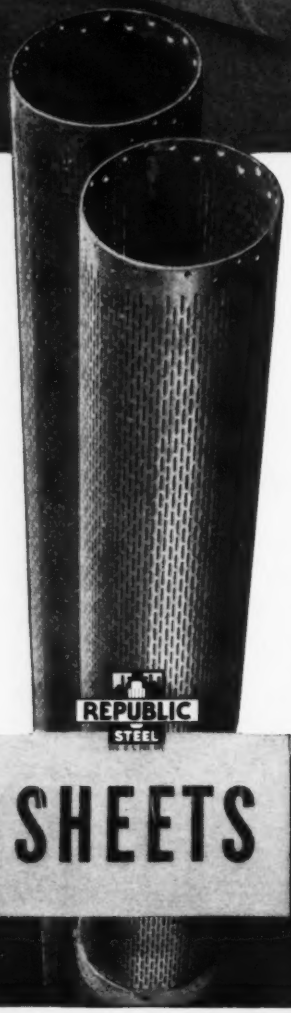
THE COVER shows a deep cut through loess on a new highway south of Vicksburg, Miss. Cut sufficiently steep to protect against saturation, these slopes stand indefinitely. *ENR Staff Photo*

Number of copies of this issue printed: 33,184

A case for TONCAN IRON



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THE WEEK'S EVENTS

Foundation Caused Dam Failure

Board reports pockets of plastic material caused collapse of Wyandotte County Dam in September

Squeezing out of pockets of plastic jelly-like material in the foundation caused the failure last Sept. 19 of the Wyandotte County Lake Dam, according to the report of a board of engineers submitted to the county commissioners Feb. 14. The dam failed by slumping of the downstream bank for half the length of the structure. (*ENR*, Sept. 23, 1937, page 495).

The board reported that the dam can safely be reconstructed if the base is widened from its present width of 500 ft. to 1,000 ft. and if the area underlying the downstream portion is cleared away to bed rock.

Robert E. McDonnell has been retained by the county commissioners to determine the expense of carrying out the proposals of the investigating board for rebuilding the dam.

The underlying rock at the dam site consists of horizontal layers of limestone and shale which are hard in their natural non-weathered state. No evidence of faulting was found, and there appears to be no reason to assign any part of the cause of the failure to the rock foundation.

The material overlying the rock was found to contain a high percentage of clayey soil; soil containing 40 to 50 per cent clay was found at many locations and a soil with 80 per cent clay was found 250 ft. down stream.

"The failure of the dam" the report held, "resulted from a plastic movement of those foundation soils deficient in shearing strength in the region about 100 ft. downstream from the center line. The plastic movement was caused by overloading of the foundation by a combination of height of dam and steepness of slope."

A visual analysis of borings without laboratory aid had led to the belief that the dam was founded on a hard blue clay, though the material actually was a silty loam. Pockets of a plastic jelly-like material, 30 to 35 ft. below the natural surface of the ground squeezed out under the weight of the dam, allowing the dam to collapse and bulged in a down stream direction. These bulges caused a rise in elevation of as much as 14 ft. at points below the down stream face.

Reconstruction of dam

Reconstruction of the dam, the board held, would involve excavation of most of the downstream half of the dam. It recommended that an area 700 ft. long extending 140 ft. downstream from the center line of the dam be excavated to a maximum depth of 45 ft. to bedrock. The area would then be filled in with sand dredged from the bed of the Missouri River. The base of the dam would be broadened and the center line would be moved up stream 159 ft., and the present 90-ft. dam height would be raised about 6 ft. In addition, the sheet pile cut-off wall and all of the material in the puddle trench would be removed from the dam "so that the line of saturation would follow a normal gradient through the impervious rolled fill and the foundation seepage would not be forced to pass above the sheet piling."

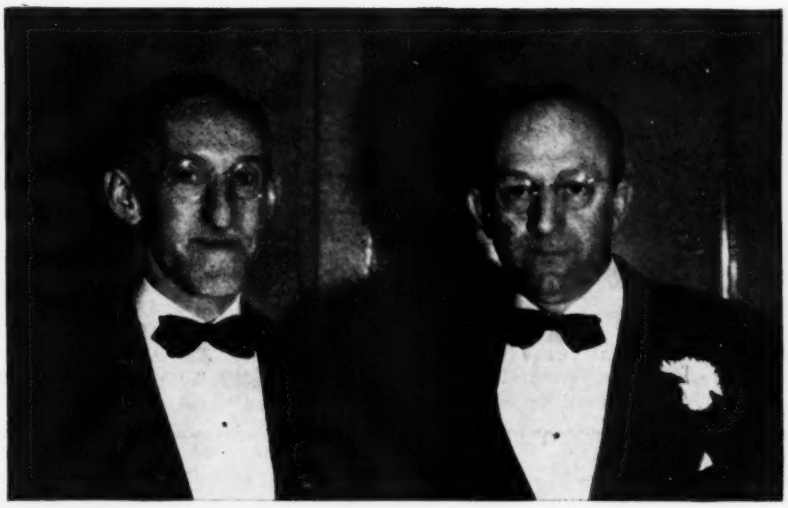
As originally built, the dam was 1,550 ft. long, 550 wide at the base and about 50 ft. wide at the 80 ft. level to which it had been built. It had a puddled clay core and was constructed of clay placed in 8 in. layers and compacted with sheepsfoot rollers. Construction work on the dam began in March, 1936. On Sept. 19 of last year about half of the downstream section, extending 800 ft. from the center line to one abutment, dropped about 50 ft.

Investigating board

Immediately after the failure, a board of engineers was appointed to determine the cause of the collapse. The board began field investigations Sept. 26 which were completed Dec. 21.

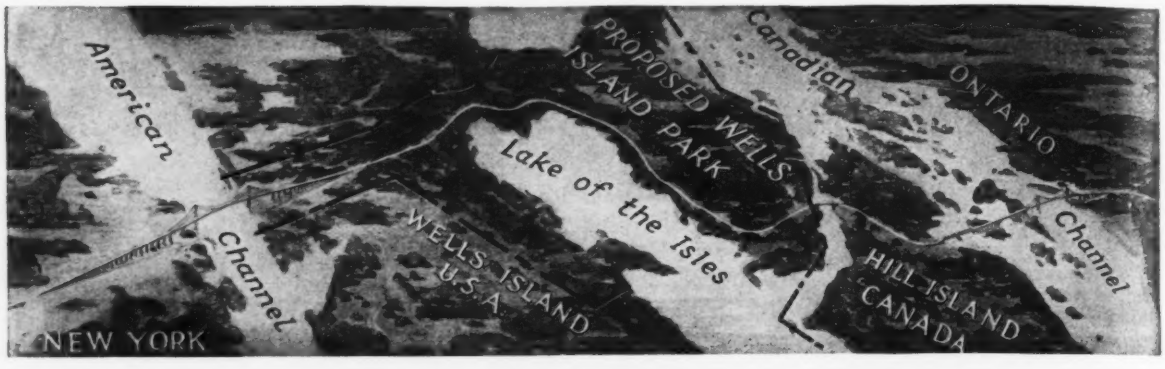
Members of the engineering board

(Continued on page 282)



PRESENT AND PAST PRESIDENTS OF THE A.G.C.

AFTER SERVING two busy years as head of the Associated General Contractors, Wm. F. Klinger *(right)* turned over the affairs of the association to the newly-elected president, Edward P. Palmer, at the close of the annual convention held recently in Washington. Mr. Palmer, of the heavy construction firm of Senior & Palmer, Inc., New York City, has served as vice-president at large for the past two years and was formerly a member of the construction code committee. Mr. Klinger returns to the directing of his building contracting business at Sioux City, Ia.



THOUSAND ISLANDS BRIDGE AS IT WILL LOOK NEXT SUMMER

RAPID PROGRESS is being made on the Thousand Islands Bridge project across the St. Lawrence River in the Alexandria Bay region north of Watertown, N. Y. Nine miles long, the project, which is scheduled to be ready for traffic in August, consists of a series of bridges and connecting highways as shown on the architectural sketch above. It is being built by a public toll bridge authority for which William T. Field, Watertown, is advisory engineer. Robinson & Steinman, New York, designed the American structures and Monsarrat & Pratley those in Canada.

The American bridge, 4,500 ft. long, contains a suspension bridge with 800 ft. main span and 350 ft. side spans; steel for the north approach and for the suspension bridge towers is erected. The Canadian bridge, 3,330 ft. long, contains a two-span 600 ft. continuous truss (erection complete), a 348 ft. steel arch (foundations finished), a 750-ft. main span suspension bridge (towers erected) and several hundred feet of viaduct, steel for most of which is in place. The international boundary is crossed by a 90-ft. span completed last fall.

FPC Sets Hearing Date On Niagara Water

The Federal Power Commission has set March 15 as the date of a hearing on the question of whether the Power Authority of the State of New York should be allowed to intervene in proceedings now before the commission relating to the diversion of water from the Niagara River by the Niagara Falls Power Co.

This hearing was originally set for last June, but was postponed at that time at the request of all parties involved.

The Niagara Falls Power Co. has asked the commission for a license to divert 275 sec.-ft. of Niagara River water through its Project No. 16 in Niagara Falls, N. Y. in addition to the 19,725 sec.-ft. which it is already licensed to use.

The Power Authority seeks to intervene on the ground that the waters of the St. Lawrence Watershed, including the Niagara River, are owned and controlled by the state of New York, that the power company has no valid rights to the water it seeks, and that the proposed diversion "is not in the common interest and contrary to the public welfare and power policy of the state of New York."

The Power Authority's intervention is opposed by the power company and by the New York State Water Power & Control Commission. The power company claims that authority over the power resources of the Niagara River is vested solely in the Water Power and Control Commission under New York State law, and that the Power Authority has jurisdiction only over the power resources of the St. Lawrence River. The company further claims that the additional diversion sought could have no effect on St. Lawrence power, and that the diversion is "consistent with the power policy of the state of New York as enunciated by the Water Power and Control Commission."

• • •

Casagrande to Lecture At Illinois

Professor Arthur Casagrande is to deliver a series of three lectures on soil mechanics at the University of Illinois under the sponsorship of the department of civil engineering. The lectures, to be delivered April 6-8, will be on "The Principles of Soil Mechanics," "Recent Developments in Settlement Analysis," and "Recent Developments in Earth Dam Design."

• • •

Wyandotte Dam Failure

(*Continued from page 281*)

are H. L. Reppart, director of WPA operations, chairman; R. E. McDonnell, of the Kansas City firm of Burns & McDonnell, consulting engineer representing Wyandotte County; G. A. Hathaway, principal engineer, U. S. War Department; and R. V. Smrha, assistant engineer, Kansas Division of Water Resources.

Road Bureau Reports On Accidents

An analysis of the nature and present control of highway accidents has been sent to Congress by the Bureau of Public Roads. The report, based on extensive field studies, has been published in six parts as House Document No. 462.

The first part analyzes the variations in traffic laws in different states, covering the differences in state motor vehicle administration, registration, licensing, liability, traffic control devices, rules of the road and vehicle requirements.

A second section describes the proper method of recording and analyzing accident data, and Part 3 shows the present situation in the various states on the collection of such information. It is pointed out that only 15 states require accidents to be reported immediately to a central agency, 19 have no central control, and 14 require no reports. The fourth section describes experience with motor vehicle inspection and tabulates requirements of the various states.

Part 5 discusses fatal highway accidents, giving typical case histories and presenting a statistical analysis of 1,715 fatal highway accidents from the 1936 records of representative states and cities.

The final section discusses the accident-prone driver on the basis of a study of the records of the Connecticut Department of Motor Vehicles.

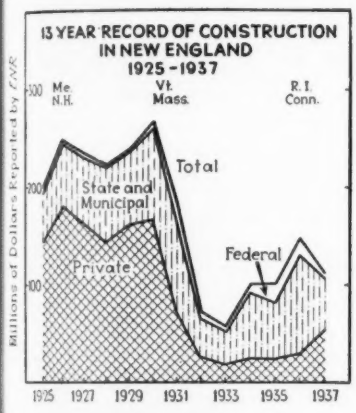
THE CURRENT TREND

This week's news of contract volume and construction cost factors

New England Volume Lower

Drop due to public work, private construction awards, highest since 1931, increased to 47 per cent of region's total

Engineering construction awards in the six New England states total $111,994,000 for 1937, or 4.6 per cent of the U. S. construction total as reported by *Engineering News-Record*. This is a drop of 23 per cent from the value of awards for the 53 weeks of 1936, but is above the yearly totals of 1932 through 1935.



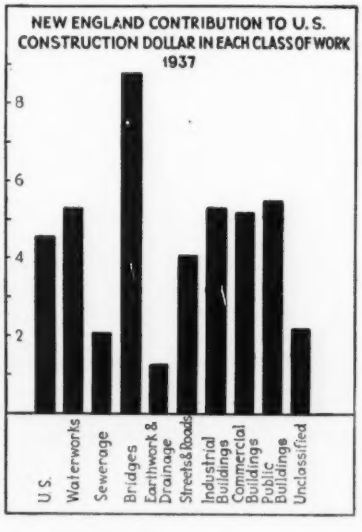
The year, 1930, with a volume of $265,254,000, is the all-time high, while 1933, with $58,594,000 is the lowest since 1917 in this section. From 1925 through 1930, the value of construction awards ranges from $199,000,000 to $265,254,000; while from 1931 to date it has ranged from $58,594,000 to $185,616,000. The annual average for the 12 years preceding 1937 is $173,000,000.

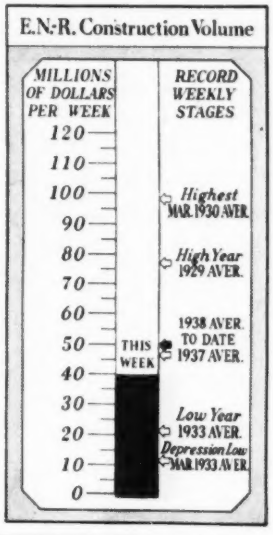
Private construction in New England for 1937, $52,227,000, is the highest since 1931, and is responsible for 47 per cent of the reported total. The highest yearly private volume, $181,589,000 reported in 1926 represented 73 per cent of the region's construction total. The low year in private awards, 1933 with $19,274,000, accounted for only 33 per cent of the construction volume. From 1925 through 1930, private awards ranged from 63 to 73 per cent of New England's construction total, while from 1931 to date, private construction has ranged from 20 to 47 per cent.

Federal construction volume, with its high of $19,385,000 in 1935, when it constituted 19.0 per cent of the construction total, has dropped to $5,552,000, or 5.0 per cent of the total, in 1937. This is the lowest federal volume since 1930. In the years 1925 through 1930 federal volume ranged from 0.4 per cent to 2.0 per cent of this section's total, from 1931 through 1937, the range has moved from 5.0 per cent to 19 per cent.

While New England in 1937 contributed 4.6c. to each construction dollar spent in the U. S., as reported by *ENR*, the average is 7.0c. for the 12 years preceding 1937. This average expenditure is 7.8c. of each waterworks dollar over the 12 year period; 5.0c. of each sewerage dollar; 5.9c. of each bridge dollar; 2.4c. of each earthwork and drainage dollar; 4.9c. of each highway dollar; 8.7c. of each industrial building dollar; 8.5c. of each commercial building dollar; 11.6c. of each public building dollar; and 3.6c. of each unclassified dollar. For 1937, expenditures per U. S. construction dollar in each class of construction in the same order are: 5.3c., 2.1c., 8.8c., 1.3c., 4.1c., 5.3c., 5.2c., 5.5c., and 2.2c.

New England's $111,994,000 construction total reported by *ENR* in 1937 is distributed between waterworks, 4.8 per cent; sewerage, 1.8 per cent; bridges, 10.5 per cent; earthwork and drainage, 1.3 per per cent; streets and roads, 15.2 cent; industrial buildings, 22.6 per cent; commercial buildings, 21.5 per cent; public buildings, 16.2 per cent; and unclassified construction, 6.0 per cent.





THIS WEEK'S FIGURES

(Thousands of Dollars)

CONTRACTS

	Week Ending Feb. 25 1937	Feb. 17 1938	Feb. 24 1938
Federal	$1,592	$2,073	$2,437
State & Municipal	10,652	21,851	22,849
Total public ...	$12,244	$23,924	$25,286
Total private ...	59,934	21,077	14,875
TOTALS	$72,178	$45,001	$40,161

Cumulative
1938 (8 weeks) $400,987
1937 (8 weeks) $362,274

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1937 8 Wk.	1938 8 Wk.
NON-FEDERAL	$183,454	$129,856
State & mun. bonds.	122,626†	60,014†
Corporate securities..	65,003	61,230
PWA loans, grants..	—4,182†	—2,497†
RFC loans	7	2,109
FEDERAL	.....	.....
TOTAL CAPITAL ...	$183,454	$129,856

† Represents transfer from federal to private investment financing through sale by RFC of PWA bonds.

ENR INDEX NUMBERS

Index Base	1913	1926
Construction Cost (Feb.)....	243.39	117.09
Construction Volume (Jan.)..	167	73

• • •

FABRICATED STEEL PLATE orders for December, 1937, total 27,463 tons, equalling the November volume, but 46.0 per cent below the December, 1936, total, according to the Bureau of the Census. For 1937, orders total 428,884 tons, a drop of 11 per cent from the 484,036 tons reported in 1936.

South Carolina Truck Regulations Upheld by Supreme Court

Court upholds legality of low weight and width limits on trucks using highways even though they impose limitations on interstate commerce

In upholding the constitutionality of a South Carolina law limiting the gross weight of trucks and semi-trailers to 20,000 lb. and their width to 90 in., the Supreme Court held that in the absence of specific congressional action a state may impose limitations on interstate commerce if no discrimination is made between interstate and intrastate traffic.

The South Carolina law was attacked by a number of truckers and trucking associations in the U. S. District Court for the Eastern District of South Carolina. The truckers maintained that the act had been superseded by the Federal Motor Carrier act of 1935, that it infringed the due process clause of the 14th amendment, and that it imposed an unconstitutional burden on interstate commerce. The district court threw out the first two contentions, but held that the law did burden interstate commerce unconstitutionally. It therefore granted an injunction against enforcement of the law.

The court based its conclusion on a finding that from 85 to 90 per cent of motor trucks used in interstate commerce are 96 in. wide and of a gross weight of more than ten tons and that the American Association of State Highway Officials has recommended a width limit of 96 in. and a weight limit of 16,000 to 18,000 lb. per axle. It also found that most of the highways affected by the act are of standard concrete or concrete base construction, 7½ or 8 in. thick at the edges and 6 or 6½ in. thick at the center, and held that these highways are capable of sustaining without injury a wheel load of 8,000 to 9,000 lb. It held furthermore that wheel or axle weight rather than gross weight is the proper basis for weight limitation.

Supreme Court findings

The Supreme Court pointed out, as had the district court, that "Congress has not undertaken to regulate the weight and size of motor vehicles in interstate motor traffic, and has left undisturbed whatever authority in that regard the state had retained under the constitution. . . .

". . . There are matters of local concern, the regulation of which unavoidably involves some regulation of interstate commerce, but which, because of their local character and their number and diversity may never be wholly dealt with by Congress. Notwithstanding the commerce clause, such regulation in the absence of congressional action has for the most part been left to the states . . .

". . . It has been recognized that a state can, if it sees fit, build and maintain its own highways. . . . Congress not acting, state regulation of intrastate carriers has been upheld regardless of its effect upon interstate commerce."

The court pointed out that states may not discriminate against interstate commerce under the guise of regulation but held that "so long as the state action does not discriminate, the burden is one which the constitution permits because it is an inseparable incident of the exercise of a legislative authority which, under the constitution, has been left to the state.

"Congress . . . may determine whether the burdens imposed on [interstate commerce] by state regulation . . . are too great, and may . . . curtail to some extent the state's regulatory power. But that is a legislative, not a judicial function, to be performed in the light of the congressional judgment . . ."

Law held reasonable

Since Congress has taken no action, and since the state legislature acted within its powers in setting the restrictions, the only question left to the court was whether the means of regulation chosen are "reasonably adopted to the end sought." "In reviewing a state highway regulation," the court pointed out, "a court is not called upon . . . to determine what . . . is the most suitable restriction to be applied of those that are possible. It is only necessary," the court said, "to ascertain upon the whole record whether it is possible to say that the legislative choice is without rational basis. . . . Not only does the record fail to exclude that possibility, but it shows affirmatively that there is adequate support for the legislative judgment."

The court went on to say that although the National Conference on State and Highway Safety, on which the lower court had relied, did recommend an axle load basis for weight limitation it did not absolutely rule out the gross weight method and that this method might well be preferable because of the greater ease of enforcement. It further pointed out that the evidence which led the lower court to its opinion as to the strength of concrete "appears to have been based on theoretical strength of concrete highways laid under ideal conditions, and none of it was based on an actual study of the highways of South Carolina." About 60 per cent of South Carolina highways were built without a longitudinal center joint and the center of these highways is, therefore, unusually thin.

Semi-trailer and trucks

No evidence had been brought before it, the court said, of a substantial difference between semi-trailers and trucks which would make it appear unreasonable to apply the same weight limitations to both types, especially if ease of enforcement is taken into account.

The width limitation, too, was held by the court to be not unreasonable in view of the fact that about 100 miles of South Carolina highway are only 16 ft. wide.

In the absence of any obviously unreasonable provision in the law, and taking account of the fact that the law was based on the recommendation of a special commission and of the state engineer, the court reversed the lower body and lifted the injunction against enforcement of the law.

• • •

Hearing Held on New Plant On Feather River

A hearing was held in San Francisco Feb. 16 before Frank A. Hampton, examiner, Federal Power Commission, on the application of the Pacific Gas & Electric Co. for permit to build a series of hydro-electric plants on the Feather River (*ENR*, Nov. 18, 1937, p. 806).

Representations were made by the California Water Authority looking to protection of the market for power from Shasta Dam when that power becomes available and suggesting a provisional permit for the proposed hydro development or use of steam standby to meet increasing power needs that confront the Pacific Gas and Electric Co. The company, on the other hand, believes that hydro power from the Feather River plant would be in the best interest of consumers and asked permission to proceed with these plants without restrictions.

April 1 was the date agreed upon by which briefs from both sides would be filed and 15 days thereafter was allowed for rebuttal.

Macdonald Resumes Control Of Connecticut Roads

State Highway Commissioner Macdonald of Connecticut has resumed control of construction and maintenance of highways, following the recent decision of the Supreme Court of Errors granting jurisdiction over highways to the Connecticut highway department (*ENR* Feb. 10, 1938, p. 195).

Plans are to go forward without change of policy for work on the Merritt Parkway. Bids were asked last week for construction of six bridges on the parkway; they are skew span reinforced concrete rigid frames. Land for right of way for future construction of the parkway will be obtained by condemnation proceedings.

NEW YORK STATE'S NEWEST BRIDGE IS ITS OLDEST

PARADOX of the above title is explained by the fact that the ancient dry stone arch bridge over Catskill Creek near Leeds, N. Y., (*top*), Dutch-built in 1760, has been replaced, after the 1936 flood undermined its foundations, with the reinforced concrete structure at the right whose facing is the original stone in exact duplicate of the design of the old bridge. Furthermore, the span lengths, 28, 63, 42 and 40 ft. as well as the rise and shape of the arches are duplicated. The old bridge was overgrown with vines, and projecting boxes have been built on the face of the new bridge so that this growth can be simulated. Only the width is changed, being increased from 23 ft. to accommodate a 30-ft. roadway and a 4-ft. sidewalk.

Preliminary to the new design enlarged photographs of the faces of the old bridge were made upon which each stone was given an identification number. Such photos were used by the field men in marking the stones for storing and replacement and by the design office in making the contract plans. Numerous close-ups of details were taken to aid in the reconstruction and for reference in case stones damaged in handling had to be replaced. Because of the wide variation in dimensions of the several spans each was designed as a two-hinged arch.

Frederick Stuart Greene, superintendent of the state department of public works, originated the idea of recreating the old bridge and gave the project, which was carried through by E. W. Wendell, state bridge engineer, his personal attention.

New Parkways Planned In New York

Program for 1938 involves spending $3,575,000 on parkways in New York City

The 1938 program of arterial parkway construction in New York City contemplates the expenditure of $3,575,000 during 1938 and an additional $4,105,000 in 1939 to complete projects starting in 1938. Most of this work is for the extension into the city of parkways in the neighboring areas. Bills to provide the necessary funds are now pending before the New York state legislature.

Largest item in the program is the expansion south into the Bronx of the Hutchinson River Parkway, a $1,900,000 project. This parkway will eventually connect with the Bronx Whitestone Bridge now under construction. (This parkway, and others mentioned, are shown on a map of the New York City parkway system published in *ENR*, Dec. 16, 1937, p. 966.)

Two other projects call for work on the proposed circumferential parkway circling the borough of Brooklyn. It is proposed to spend $900,000 for improvement of the Southern Parkway west from its connection with Laurelton Parkway, thus providing a connection with the Southern State Parkway in Long Island; an additional $900,000 will be required for this project in 1939. It is also planned to spend $750,000 to begin another section of the circumferential parkway extending west from the junction with the Marine Parkway; $850,000 will be required for this in 1939.

Also included in the program is expenditure of $875,000 for the elimination of bottlenecks in the Cross-County Parkway in Westchester County (not on map). It is planned to spend $345,000 to connect the Cross-County Parkway with the Sawmill River Parkway and to build a new viaduct at Fleetwood to replace an existing structure at a cost of $530,000.

• • •

Memphis Gets PWA Money For Municipal Power

The first payment from PWA money allotted to municipal power projects, which has been held up by court litigation until released by the Supreme Court early this year, was paid when $1,031,000 was turned over to the city of Memphis for the new Memphis power distribution system. This is the first installment on a PWA grant of $3,092,000 for a distribution system to distribute TVA power to the city.

Epidemic is Blamed On Water Supply

Minneapolis typhoid outbreak in 1935 caused by low chlorine residual water

The 1935 epidemic of typhoid fever in Minneapolis which included 175 cases between May 4 and Aug. 10, 1935, is attributed to the maintenance of an insufficient chlorine residual during a period of high pollution of the raw water supply in a report presented to the city council by the state health department.

The report points out that the typhoid outbreak began less than a month after the residual chlorine in the city water had dropped below 0.1 parts per million and ended about a month after the residual chlorine content was increased to 0.3 and 0.5 parts per million. "It has been shown experimentally," the report said, "that recently isolated typhoid bacilli may survive for eighteen hours or longer in the same degree of chlorine concentration as was present in the distributed water at the time of this epidemic."

The cause of the epidemic, in the view of the health department, was the low chlorine residual coupled with an unusually high degree of raw water pollution. The possibility of these circumstances was laid in the report to inadequate examination of raw and treated water. The report also indicates that "there is a considerable number of physical defects in the pumping station, the purification plant, and the distribution system, and in plumbing systems both privately and publicly owned."

To avoid danger in the future the department recommends changes in certain physical features of the municipal water supply and improvements in the administration of the waterworks, particularly the appointment of a "qualified public health engineer" in the office of the commissioner of health to devote his full time to the solution of problems concerning the water supply.

• • •

Grand Coulee Contractors Change to New Name

The Interior Construction Co., the organization to which a contract was awarded for completion of the Grand Coulee Dam, has changed its name to Consolidated Builders, Inc. This change was made, it is reported, to avoid close similarity to and possible confusion with the Department of the Interior under whose officials the Grand Coulee work will be done.

Unlicensed Engineer Illegally Elected

The Ohio State Supreme Court refused on Feb. 16 to reconsider its decision of Jan. 19 in which it held that Robert S. Wheatley was illegally elected county engineer of Columbiana County, Ohio, last November. Mr. Wheatley was not then a licensed engineer. At the election in November, 1936, Mr. Wheatley and Lloyd C. Kirk, the incumbent, were candidates, and Mr. Wheatley received the most votes.

Ohio law requires that a county engineer be a registered engineer or surveyor. Alleging that Mr. Wheatley did not fulfill this requirement, Mr. Kirk refused to surrender the office when his term expired in January, 1937. He later did so on order of the Common Pleas Court, but on appeal to the District Court of Appeals, Mr. Wheatley was held illegally elected, and the case was taken to the Supreme Court.

The court held that, since Mr. Wheatley was disqualified, no one had been legally elected to the office. The court ordered Mr. Kirk to continue in office until a successor had been elected and qualified.

Mr. Wheatley formerly taught engineering subjects at Ohio State University. Prior to his election last November, he was resident state highway engineer in Columbiana County.

Big Power Development Planned by Soviet

A large program of public works in the Soviet Union is said to include the construction of a $2,500,000 kw. power development on the Volga River—four times the size of the hydroelectric plant on the Dnieper River which was built by the late Colonel Cooper. This plant, according to reports to the New York *Times*, is to be built within the next five or six years. It will also serve to irrigate land in the Volga Valley. Work is already in progress on two dams at Uglitch and Rybinsk, which will raise the level of the Volga several feet, and large power stations are to be built in connection with these also.

Other large projects announced at the same time include a big reservoir at the junction of the Kama Petchora and Vychedta rivers and a 600,000 kw. hydroelectric station near Solikamsk.

Slum Removal Deferred By Straus Order

Straus will relax requirement that slums be cleared before building starts

Cities using federal aid to obtain low-cost housing may temporarily defer clearing slums and concentrate on building new housing facilities, according to an order issued Feb. 16 by Nathan Straus, housing administrator. The Wagner-Steagall housing act, under which the U. S. Housing Authority acts, specifies that slum dwellings equal in number to the new housing units constructed must be demolished. The act, however, Mr. Straus holds, gives him discretion to postpone slum clearance where the requirement is delaying solution of an acute housing shortage.

The order, however, Mr. Straus emphasized, does not release cities from their legal obligation eventually to clear slum areas.

Project rentals set

The U. S. Housing Authority has set rentals for projects in Philadelphia and Camden, N. J. A rent schedule of $7.25 per room per month, including all utilities and services, or $5.08 per room for space alone, was set for the $2,100,000 Hill Creek project in Philadelphia. At the same time an agreement was made with the Philadelphia Housing Authority under which the project will be leased to the authority as soon as it is 50 per cent rented.

Rentals averaging $4.89 per room per month for space and an additional $2.43 per month for utilities, have been set on the $3,116,000 Westfield Acres project in Camden. Rentals including utility service range from $23.60 for a three-room to $32.80 for a five-room apartment.

New earmarking

The number of cities participating in the federal housing program mounted to fifty Feb. 9 when $9,450,000 of federal funds were earmarked for six additional cities. The new earmarkings, raising the total of funds set aside for local housing authorities to $168,445,000 are as follows:

Akron	$1,800,000
Baltimore	5,400,000
Frankfort, Ky.	450,000
Temple, Texas	180,000
Vincennes, Ind.	270,000
Wheeling, W. Va.	1,350,000

Insurance law changed

Insurance companies in New York state are allowed to invest their funds in low rental housing projects until 1943 under the terms of a bill passed Feb. 8 by the New York Legislature.

WASHINGTON HIGHLIGHTS

Special reports by Paul Wooton

BEFORE PASSING the bill appropriating an additional $250,000,000 to relief purposes, the House of Representatives rejected two amendments, one of which would have prohibited the Works Progress Administration from constructing buildings costing over $25,000, and the other would prohibit purchasing heavy construction machinery.

A BILL authorizing the appropriation of $743,000 for land acquisition, to complete the Great Smoky National Park in North Carolina and Tennessee has been signed by President Roosevelt. The government now owns 410,000 acres and will add an additional 26,000 acres as soon as an appropriation is made.

OFFICIALS of the Pennsylvania State Turnpike Commission, formed to construct a toll highway between Harrisburg and Pittsburgh along an abandoned railroad right-of-way, will ask the Works Progress Administration for an allocation of $20,000,000. It is claimed that the request has the approval of President Roosevelt. The balance of the $55,000,000 cost would be financed by the sale of bonds.

PRESIDENT ROOSEVELT has approved a WPA relief project allotting $992,984 to a general rehabilitation program for the municipal street railway system of Detroit, Mich. The proposed program is citywide in scope and includes numerous individual jobs of track reconstruction, rerouting and removal. The money will not become available until the project receives the approval of the Comptroller-General and WPA's state director for Michigan.

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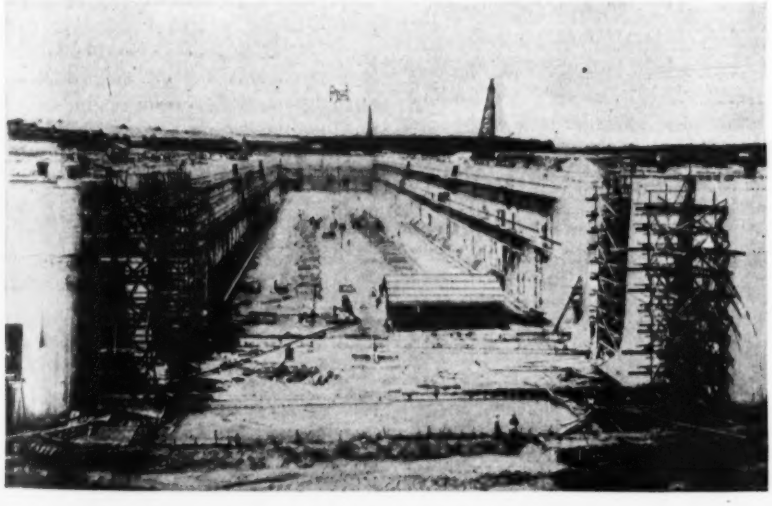
Railway Show Moves

The Railway Show, held in connection with the annual meeting of the American Railway Engineering Association, is to be held this year in the International Amphitheatre at the Union Stock Yards, Chicago, after being at the Coliseum for many years past. This year's show will be the 27th annual exhibit of the National Railway Appliances Association. It will be held March 14-17. The American Railway Engineering Association will meet at the Palmer House March 15-17. Special buses will run between the hotel and the amphitheatre.



GRAVING DOCK MAKES HEADLINES

THIS is the new graving dock at the British naval base in Singapore, dedication of which Feb. 14 made the front pages because of the presence of American naval vessels.

The dock, capable of docking any ship in the British Navy, is 1,000 ft. long and 130 ft. wide, with a depth of water over the sill of 35 ft. at low water.

The dock was constructed by Sir John Jackson, Ltd. as part of the main contract for the naval base. The entrance caisson was built by Sir William Arrol & Co., Ltd. and the dock pumping machinery by Gwynnes Pumps, Ltd. The dock is shown as it appeared some time ago with the dock itself nearly complete but without the caisson gate.

LABOR NOTES

A THREAT of a general strike on all federal work in the St. Louis area, totaling about $20,000,000 worth of construction, has developed as a result of the common labor strike on the clearing operations above Alton Dam (*ENR*, Feb. 17, 1938, p. 253). Owen Femmer, representative of the St. Charles local of the International Hodcarriers, Builders and Common Laborers Union, reported the new development after attending a meeting of the Building Trades council in St. Louis. He said the Council had wired Congressmen protesting against actions of the U. S. Engineers, in charge of the project, and made the threat of a general strike. The union wants the U. S. Engineers to pay 67½ cents an hour for a 40-hour week. At present they are paying a scale of 44 cents an hour for 48 hours a week, while requiring only 44 hours of work. They are said to plan an increase to 50 cents in the near future.

THE SEATTLE Central Labor Council has adopted a resolution endorsing the six-hour day and calling for individual locals affiliated with the central body to express a similar endorsement. This action is in answer to the announcement by members of the Seattle Chapter of the Associated General Contractors that they would carry on commercial building construction in that city on an 8-hour basis after March 7 (*ENR*, Feb. 17, 1938, p. 253). An agreement containing the 6-hour day provision expired Feb. 1 and has not yet been renewed nor has a new agreement been negotiated.

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Moloney Appointed Editor Of Canadian Publication

Grant Moloney, a civil engineer of London, Ont., has been appointed head of the editorial department of the *Canadian Engineer*. Mr. Moloney, a graduate civil engineer, has had nine years experience in the design and construction of engineering structures and road machinery. He has done surveying and appraisal work for the London Gas Co., was connected for four years with construction companies and has served on the staff of Tyng & Tyng, and Archibald & Dillon, consulting firms of Buffalo and London respectively. He was for 18 months designing engineer for the Dominion Road Machinery Co. of Goderich, Ont.

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

Soil Mechanics Conference

Sir: The First International Conference on Soil Mechanics and Foundation Engineering, held in June 1936 at Harvard University, was a most heartening experience for all participants, the provision of this truly international "clearing house" for a new branch of study in civil engineering within a few years of its real start being most encouraging. This encouragement was confirmed and strengthened by the resolutions passed on the closing day of the conference, with but one dissenting voice, calling for the continuation of this clearing house through the medium of local national committees, and the repetition of the conference in a few years.

Since that day, now eighteen months ago, we—Canadian engineers participating in the conference—have heard nothing with regard to this proposed continuation of the conference, and this we regret for a number of reasons. Perhaps because we are Canadians, having contacts with both the United States and Great Britain, we realize the supreme value of such international cooperation as was displayed at the conference. This good start will be lost unless the conference can be continued. Already various local committees have been set up in different countries the work of which does not appear to be correlated. In the brief period since the conference, the literature of the subject has increased tremendously, and this also needs correlation. Further if useless duplication of reasearch work is to be obviated some such "clearing house" as the conference provided is essential. Finally, this inaction seems to be a poor tribute to the magnificent organizing work of Dr. Casagrande and his associates at Harvard in their conception and operation of the first conference.

As American engineers in general, with your editorial support, have made so great a contribution to the advance of this new branch of study we feel that we may properly solicit your assistance in seeking an explanation of the present situation, and in an attempt to see some action taken before it becomes too late and the future progress of soil studies becomes locked in national watertight compartments. Specifically we would suggest (a) the implementing of Resolution No. 3 of the closing session of the conference with special reference to dues so that a central office can be started, and (b) an investigation of the possibility of holding the second conference in Holland in 1940 (as was suggested at the Harvard Conference).

J. M. R. FAIRBAIRN — R. J. MATSON
R. F. LEGGET — I. F. MORRSON
J. W. LUCAS — G. M. WILLIAMS
C. R. YOUNG

Intermediate Analysis

Sir: I have just read in your issue of January 20 the article entitled "Influence Lines by Moment Distribution," by F. Kruys. I thought you might be interested to know that methods substantially the same as this were outlined by two of those who discussed Prof. Cross's paper, "Analysis of Continuous Frames by Distributing Fixed-End Moments," as published in the 1932 *Transactions*, Am. So. C.E. One of these, by the writer, appears on page 93 and the other by G. M. Dillingham appears on page 125.

E. G. HARTMAN
Research Engineer,
Aluminum Company of America

Progress in Design Studies

Sir: The writer has read with some interest the article published in the issue for Jan. 20, 1938, by F. Kruys of The Netherlands, on the determination of influence lines by moment distribution. The procedure suggested by Mr. Kruys is not new and has been used in this country by various engineers.

The Chicago Park Commission in the design of some of its continuous girder bridges on the lake front in Chicago have used a very similar method. A discussion by R. A. Black, assistant chief engineer, Chicago Park Commission, in *Transactions* of the American Society of Civil Engineers (vol. 96, p. 35), indicates the problems encountered in their treatment of concentrated load systems. A discussion by E. C. Hartman, research engineer, Aluminum Company of America, in the same issue of *Transactions* (p. 93) outlines an identical method. Also, in the book "Continuous Frames of Reinforced Concrete," by Cross and Morgan, published by John Wiley & Sons, the exact procedure discussed by Mr. Kruys is presented with some amplification (p. 260).

However, these references do not detract from the value of Mr. Kruys' article, which gives a definite illustration to show the procedure in getting influence lines for moment at various points in a continuous girder. Repetition of this nature serves to establish the wide usefulness of the Cross technique. The many contributions to the technical literature in this country about the moment-distribution method and its variations, and the wide-spread adoption by engineers of design, testify to the high position attained by this mode of analysis in America. It particularly pleases the writer to find this most recent contribution submitted by a Dutch engineer engaged in active practice, and he hopes that it evidences a growing interest on the part of European engineers in this method which has so facilitated intelligent study of the designs of many engineering structures.

HAROLD E. WESSMAN,
Professor of Structural Engineering,
New York University
New York, Jan. 25, 1938

Praise for Mr. Wright

Sir: Fresh from the Orient where every American's prestige is strengthened and every American architect and engineer stands in the reflected glory of Frank Lloyd Wright and his Imperial Hotel at Tokyo, I began reading the *Engineering News-Records* that had accumulated during my absence. Eventually I came to the Dec. 9, 1937 issue that is devoted to "Buildings that Express New Trends". There again proof was given that Architect Frank Lloyd Wright was not through—as concretely expressed by his introduction

of the "Morning Glory" column.

But to return to Tokyo. Japanese and other nationalities speak proudly of the Imperial Hotel that had withstood the 1923 earthquake. In any catastrophe of nature a place of refuge is appreciated. If the gratitude of humans could contribute to the happiness of Frank Lloyd Wright, those who sought refuge in the Imperial Hotel in 1923 should talk personally with him. No doubt, many have.

Farther West in the Far East was Shanghai. Bombs and artillery shells landing on buildings showed that they were not yet entirely safe for human occupancy under the varying conditions of today.

How about it, Mr. Wright? Will you give us a bomb-proof building? A building that is fifty years ahead of time? Another refuge for hundreds of human beings when another catastrophe, man-made but none the less destructive, overtakes them?

Architect Frank Lloyd Wright has been producing work since 1900 that is now called modern. Like a lone tree, silhouetted against the setting sun of the desert, Wright stands alone as the most creative architect that has ever produced in America. In the same way, he stood alone for many years when his work was not recognized as that of a genius. "A prophet is without honor in his own country."

While thinking of his genius, let us not forget to thank the men who had the courage to back him, most recently Mr. Johnson who sees fit to advance building by his expression of faith in unorthodox construction.

EDWARD E. TUFTE
Grand Forks, N. Dak., Feb. 2, 1938

Relaxation of Constraints

Sir: In a letter printed in your issue of April 1, 1937, I called attention to the method of stress-calculation for frameworks by systematic relaxation of constraints developed by Professor R. V. Southwell in England and published in the Proceedings of the Royal Society of London, Series A, Vo. 151, pp. 56–95 and Series A, Vol. 153, pp. 41–76.

This year two more papers continuing the same line of investigation have appeared. In accordance with a suggestion made in Professor Southwell's original paper, Mr. H. J. Hopkins ("ENGINEERING", Vol. 143, p. 469, April 23, 1937) has demonstrated the application of this method to continuous beams.

Both the original treatment and Mr. Hopkins' extension of it were restricted to cases in which *EI* (flexural rigidity) and *w* (line intensity of loading) are constant between supports. By proposing an approximate solution for the deflection of a non-uniform beam, whether caused by a varying load or by terminal displacement or rotation, Professor Southwell has not only removed this restriction but suggested methods valuable in themselves. He proposes two solutions, one of which (except for a useful initial modification of the data) is fairly straightforward numerical integration, the other an ingenious application of the method of successive relaxation of constraints. Any desired accuracy can be obtained by carrying the approximation sufficiently far.

Professor Southwell states his intention of treating, by these same methods, more complex problems, such as those of beams subjected to transverse and end loading in combination, the critical loads of struts, and the natural frequencies of air-screw vibrations. His paper, entitled "Relaxation Methods Applied to Engineering Problems. I.—The Deflexion of Beams under Transverse Loading", appears in the Proceedings of the Royal Society of London, Series A No. 905 vol. 161, pp. 155–181 July 1937.

DAVID C. WILLIAMS,
Department of Mechanics, The Ohio State University, Columbus

Piledriving in Debris Fill

Sir: Your article on "Piledriving in Debris Fill," in the December 30th issue was highly interesting, but I did not think it warranted special editorial comment.

For your information, open end pipe piles were driven for the Jersey City Terminal Warehouse, Pennsylvania Railroad, back in 1930–31.

We did one thing over there, however, which I found no mention of in this article, and that is the retapping of these open end pipe piles after same had been blown out and cleaned. We found that in some instances the casing unseated itself from the rock and came up some 6″ to 8″. The retapping was done just prior to the concreting of these piles.

For further information: a piling contract recently completed in Cleveland aggregates 723,000 lin. ft. This footage has been exceeded by a single pile job now being completed in Detroit.

W. C. PIET
Pittsburgh, Pa., January 13, 1938

The Engineer's Position

Sir: I have read several articles in *Engineering News-Record* regarding the advisability of an engineer's joining a union. The attitude toward this matter seems to be one of more or less indifference on the part of engineers whose advice and sympathy toward the younger members of the profession would be appreciated.

It is my opinion that the place of the engineer in public life is neither on the side of labor nor capital. Due to his education and experience, he should rather be an arbiter or judge in cases of contact with either one, or arguments involving either one or both.

From the viewpoint of shortsightedness, the allure of an increase of wages will lead a young man to believe that he is bettering himself, but he is merely placing himself in a rut where his initiative and ambition will be of little avail in long range planning. If a man has determination and a desire to succeed, he had better not affiliate himself with a union.

I believe in labor unions and know that labor has to organize to deal with capital, which is also organized, but an engineer is classed with the professions and should be governed accordingly. We have an association of engineers and should make it as much of a power in the engineering field as the American Bar Association and the American Medical Association occupy in their respective fields.

It is somewhat discouraging for a young engineer to work for a small wage, but the employer is bent on making a good profit and will sometimes appear to be holding his employees back. However, if they keep their eyes open and learn all they can about the work, the opportunity will eventually present itself and the young man will be ready for it.

G. E. WOODWARD
Wolf Point, Mont.

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Editor, F. E. SCHMITT · *Editorial Staff*, V. T. BOUGHTON
N. A. BOWERS, W. G. BOWMAN, W. W. DE BERARD
C. S. HILL, H. W. RICHARDSON, E. J. CLEARY

Editorial Offices at 330 West 42nd Street, New York

FEBRUARY 24, 1938

THE RECORD of what the highway engineers of Mississippi have done in less than two years, starting from scratch, as given in this issue is one of which any group of men may be proud. They built up an organization, laid down a system of state roads, determined where there must be new location and where reconstruction of existing roads, and had the whole $42,000,000 of work under contract within 19 months. Especially notable is the way in which large-scale relocation was undertaken with new roads laid out to avoid passing through the congested streets of towns. But the record also speaks loudly of the disadvantages of having to do such work in haste. Things were done in the early stages of the work that later were recognized as being undesirable, and the pressure under which the early part of the work had to be carried out introduced many difficulties. Thus the record has a dual significance; it shows what can be done in an emergency to correct conditions that were becomming intolerable, and it shows also the need for long-range planning for future highways in order that road funds will be spent most effectively.

Unforeseen Dangers

RICHARD S. BUCK in his personal story of the upper Niagara arch, published in this issue, brings out that when the bridge was planned the available ice records gave no reason to foresee that it might sometime be endangered by an ice jam. Confirming the belief expressed in these pages four weeks ago (Feb. 3, 1938, p. 171), his account establishes the January ice condition as a rare and extreme emergency. Strengthening of the bracing near the foot of the arch after damage by unusually high ice packs early in the life of the bridge—evidently done with a view to protecting the structure in any contingency—offers further proof that no attack as severe as that of 1938 was considered possible. Thus, experience demonstrates in this case as in many others that the record of past happenings is no guarantee of the future, but that unforeseen conditions are likely to occur in the life of any structure or enterprise. It is therefore not necessarily wasteful if the planner gives some thought to unforeseen possibilities, and not necessarily extravagant to include in a project some provision against such possibilities, at least if their consequences appear sufficiently serious.

Neglected Draftsmanship

IS ENGINEERING DRAWING on the downgrade? The question is raised by reproductions of drawings in current state and federal reports and by lantern slides used in connection with society meetings. In many the details are so blurred and the lettering so small and indistinct as to create a definite impression of sloppy work on the part of the draftsman. Obviously, many of these drawings were not prepared to be reproduced on a small scale, but many were. In making the latter the engineer, who is supposed to be able to visualize his finished product, followed routine practice with no recognition of the special requirements to be met. Yet more and more drawings are being reproduced at small scale for general use. It appears to be high time that this regrettable condition is corrected. The methods by which it can be done are well known to engineers.

Sand and Water

MODEL EXPERIMENTING will be put to a new test of its possibilities by the beach-erosion investigative work which Col. E. I. Brown outlines this week. The problem involved is one of the most refractory in the whole range of civil engineering operations. The engineer who deals with the beach depends on two of the most mobile working materials known—water and sand; with these he must build structures resistant to storm wave, undertow, and current. Whatever auxiliary structures he may contrive of more substantial materials are little more than a means for causing the beach to build up a wave-proof profile and maintain itself through all changes of weather. The physical laws and relations involved are little known even qualitatively, and quantitative knowledge is wholly absent; such items as mechanism of wave attack, transportation of material by the littoral drift, causes of shoal and bar formation, or stability of sand slopes under turbulent water flow, are still unexplored. Undoubtedly the experimental method can do something to clear the ground for progress. How much it can accomplish remains to be learned from the results of the new laboratory's work.

Engineering Approach

A PUBLIC-WORKS PROBLEM highly controversial in nature has been approached from a practical engineering standpoint in the study of the Congress St. improvement in Chicago, reported in last week's issue. The matter at issue is the question of

how to route an arterial highway through the West Side area, a problem long considered one of the "hottest" of its kind. Fourteen rival routes westward out of the city had been proposed. Finally the problem was referred to a committee of engineers. Attacking it in a novel way, the committee built up a rating table in which each factor and sub-factor was assigned a definite weight—safety, capacity, cost, construction difficulties, esthetics, and the like, each with two to ten component factors. By analyzing the various routes with respect to these factors and giving them individual ratings, it obtained a quantitative comparison. In the light of the method used there is hope that the West Side highway may now be put under construction. In any case the solution of the problem represents an important achievement. In this day of harebrained proposals for public-works projects of all conceivable sorts, the Congress St. report stands out in bold relief as an example of sound and sane project study.

Ducks or Mosquitoes?

THE PERENNIAL ARGUMENT of wildlife preservers versus mosquito abaters makes the front pages of the newspapers once again. Each year the proponents of sports paradises grow vociferous in their demands that mosquito control measures be modified wherever this work might be contrary to the best interests of ducks, birds and marsh animals—and the people who later hunt and kill them. According to accounts of proceedings at the North American wild-life conference last week the matter reached the point where members of different bureaus in the federal Department of Agriculture were lined up on opposing sides.

The Biological Survey is opposed to marsh drainage projects and wants them kept "within reasonable bounds"—more specifically, within a radius of five miles of a town. This would be just fine if somebody could convince the mosquitoes that they must not invade the five-mile limit. Unfortunately they are independent creatures.

Stripping all arguments to their bare essentials the question is this: shall we continue the campaign against the ubiquitous mosquito which deals disease and discomfort or shall we abandon abatement measures in favor of maintaining game "refuges" where a privileged few may slaughter at leisure?

Sanitarians and others who are working toward the preservation of public health can hardly be expected to subscribe to the latter program and relax their efforts in furthering mosquito abatement. It is not easy to forget that 10,000 deaths a year are caused by malaria—a mosquito-borne disease—in the southern states alone, and that malaria epidemics are not unknown in regions as far north as Wisconsin. When it comes to a question of ducks or human lives, let us forget the ducks.

Canada's Call

FROM CANADA comes an appeal that addresses itself to the engineers of every country. It is a call to a second soil-mechanics conference to carry forward the work begun at Cambridge in 1936 toward establishing worldwide cooperation in the development of better engineering knowledge of soils and earth structures. The seven Canadian engineers whose letter appears on p. 288 voice a thought that has been in the minds of many who joined in the brilliant Harvard gathering. It is a thought that deserves consideration and action.

A second conference is sorely needed. The men who entered the new field of study and are marking out new roads to safe and efficient construction carry on their work largely in isolation. Yet East and West find themselves confronted by identical problems, and they have need to assemble for joint discussion of experiences in order that they may not go wrong in working out these problems but may be guided by the light of clearest understanding. What was accomplished in this direction through the first conference gives ample assurance that its successor will be fruitful of good results.

It may be said, and with truth, that such a conference is certain to come about, that it is inevitable regardless of present action. The mutual attractive forces that draw together scientific and technical men inspired by a common purpose are powerful in their effect and will sooner or later bring these men together in joint session. But to depend on such natural processes will lose time that should be saved; error and schism are likely to grow up, and the compartmenting of individual groups to which the letter refers may establish itself. It will be a measurable gain if the world conference is brought together two years hence rather than at some indefinite time after that, possibly 1945 or later.

In making a timely proposal the Canadians have done their part. It is for others to take up the thought advanced and develop it to the stage of action. The American committee that was formed at the Cambridge conference has an excellent opportunity here. It is competent to carry on the necessary conversations preliminary to a choice of time and place and to set in motion the further preparatory activities. American engineers, largest gainers from the first conference, could hardly make more fitting return than by taking up the duty of preparing for continuance of the work.

PICTURES IN THE NEWS

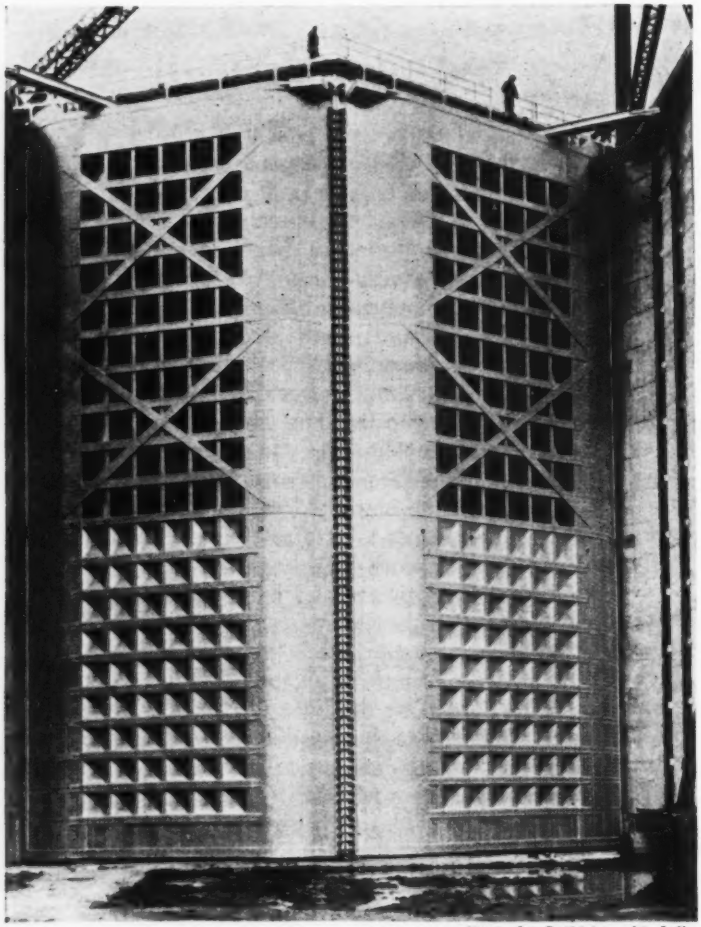
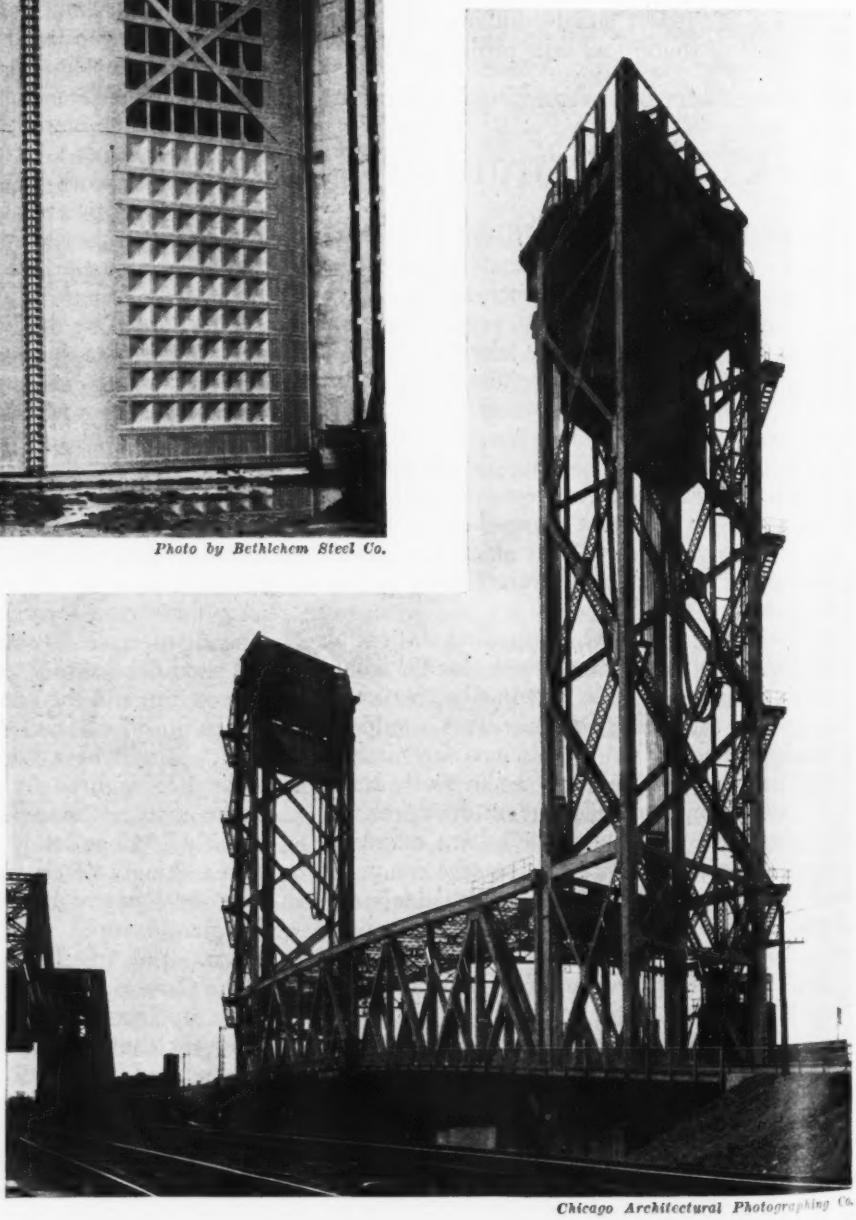


Photo by Bethlehem Steel Co.

WORLD'S HIGHEST lock gates, which will serve at Bonneville Dam. Weighing 600 tons and towering 100 ft., these are 17 ft. higher than lock gates used in Welland Canal and 18 ft. higher than those used in Miraflores locks of the Panama Canal.



Chicago Architectural Photographing Co.

TORRENCE AVE. lift bridge, Chicago. Put into service recently, this 276-ft. vertical-lift structure was built at a cost of $1,330,000. It is set at a 34½-ft. skew, and provides 125-ft. clearance when raised.

Mississippi Highways

State-wide program of trunk highway construction inaugurated in 1936 with an authorized expenditure of $42,500,000 all put under contract in nineteen months and now well along toward completion of the initial stage

CONTRACT LETTING on the initial stage of Mississippi's highway program was practically completed at the close of the year 1937. Thus, in less than two years the state highway department has put under contract all but half a million dollars worth of the $42,500,000 authorized by the state legislature in January, 1936.

The program of work now drawing to a close marks the inauguration of state-controlled highway improvement on a large scale in Mississippi. Previous to the passage of the Stansel Act in 1930 nearly all of the road construction work supervised by the department was done in cooperation with the counties, who financed fifty per cent of the work in combination with regular federal aid. After passage of the Stansel Act the reorganized department supervised the expenditure of such funds as were made available to the state as direct grants from the national government, and it was not until the passage of the Highway Act in 1936 that a definite program with regard to the improvement of certain state highways was undertaken, financing the work partly with state funds as provided by the legislature in that year.

On federal-aid work prior to 1936 the standards set by the U. S. Bureau of Public Roads had to be met, but there was no plan for developing continuous highways that could serve as through routes. The program laid down by the act of 1936 was described in our issue of March 4, 1937, p. 335. Briefly, it called for completion of a 2,720-mile system of trunk highways running across and up and down the state. Of this mileage, 923 had been hard-surfaced and 420 miles had been graded and drained but not surfaced before the program was begun. This left 1,375 miles to be graded, and 1,800 to be paved, of which 1,200 were scheduled for grading and draining under 1936 program, and 957 miles for paving.

Previous to 1936 no funds were available for state-controlled work, other than emergency grants from federal governments. Counties issued highway bonds to match the federal-aid funds. The 1936 legislation provided for the sale of highway bonds in the amount of $23,000,000, $18,500,000 of which was used to match a $15,000,000 grant by the Public Works Administration on a 55-45 per cent basis. $4,500,000 of the $23,000,000 was used to match the regular federal-aid allotment for the years 1936 and 1937. The legislature in providing the state's share of the $42,500,000 further designated the system on which the funds could be spent, which at that time was comprised of approximately 2,720 miles. The state's share of the obligation, $23,000,000, was to be repaid by impounding 1¼c. of the state highway department's 3½c.-share of the gasoline tax. Thus the program was instituted without additional taxes, and although the bonds sold for the financing of the program were anticipated to be repaid within approximately twenty years the present income from the gasoline tax indicates that the entire $23,000,000 can be repaid with 12 or 13 years.

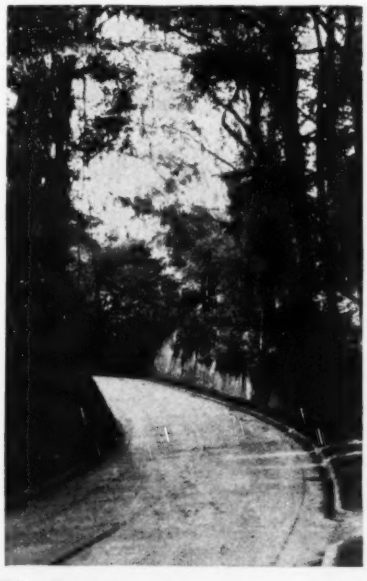


Fig. 1. Old roads are picturesque but too narrow and winding for present-day needs.

After the program had been definitely planned and approved by the Public Works Administration and the State Highway Commission there remained only fifteen months in which to place under contract approximately $33,500,000 of the regular federal aid constituting the 1936 regular federal-aid program. Since these funds were scheduled to be obligated by June, 1937, with the task of placing $38,000,000 under contract in such a limited time confronting the department, director E. D. Kenna with the various departmental heads adopted a plan whereby two lettings would be held each month, so that awarding of contracts could be made at such regular intervals as to meet the requirement of placing the greater part of the funds involved in the program under contract by the then dead line date of June 30, 1937.

Relocations needed

Fortunately, the state highway department with its limited forces had been able to study the state road system sufficiently before the 1936 program was inaugurated to know that relocation was needed in many places. The department had been able to make preliminary reconnaissance

Fig. 2. To save grading, vertical curves were made too sharp on some of the earlier work. Foreshortening exaggerates the roller-coaster effect on long tangents.

in some regions, but much field work remained to be done. Therefore, as soon as the new program had been approved, the department immediately added to its engineering forces, using men from the existing staff as assistants to the heads of district offices in regions with which they were most familiar. At the peak of the work, 851 engineers were employed in the field, and 185 men in the drafting offices, the latter being on three 8-hr. shifts.

Mississippi generally is rolling country with no pronounced land formations. Main river valleys are flat and meandering with side drainage coming in through deeply eroded valleys. As a consequence, any reasonably straight line rises and falls rapidly in much of the state, and no amount of study can improve the profile greatly, except by introducing excessive curvature or unjustifiably deep cuts and high fills.

Faced with this situation, the highway department decided to take the shortest lines between key points as the basis for relocation work, modifying that line only where it was obvious that savings could be made. As a result, the relocated roads run in a practically straight line for many miles, one tangent reaching a total length of 30 miles. The net saving that has been accomplished by the straightening of roads is impressive; one stretch near Natchez has been reduced from 23 miles to 14 miles. The old road in that region had been laid out along the line of least resistance and followed the edge of the tableland around gulleys rather than being cut across them.

There is a conspicuous absence of sharp horizontal curves. Sight distances, both horizontal and vertical, were set originally at not less than 500 ft. Vertical distances on more re-

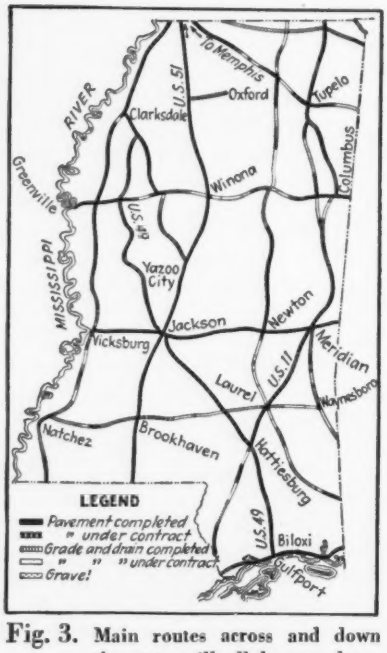


Fig. 3. Main routes across and down the state will all be paved under the present program.

cent work have been increased somewhat because of frequent criticism of the sharp vertical curves in the initial work. The desirability of longer vertical sight distances was recognized by the department at the outset, but because of the sharply rolling nature of much of the country through which the roads run, an increase to 1,000 ft. would have added 20 per cent to the grading costs. When density or traffic increases to a point where the lack of vertical sight distance introduces a serious risk, the department plans to add additional lanes, separating the opposing lanes of traffic.

Towns by-passed

Wherever possible the larger towns with congested streets have been by-passed, the new road being brought in close enough for an easy connection to the principal streets of the town. In a few instances local opposition to the by-pass was so strong that the new highway had to be brought directly through the center of town. However, in some cases it was found practical to lay out the new road on an alignment that will permit construction of a by-pass at a later date.

Grading

Grading work presented some unusual problems unknown in regions having more stable soils. Except for the deep loess deposits that cap the bluff along the Mississippi river, the soil over the greater part of the state is made up of extremely fine sand, silts and sandy silts, and very unstable clays and sandy clay mixtures in layers of varying depth overlying cherty gravel. Soft mucks are found in the river bottoms. Along the Mississippi river, the loess, a wind-blown material, much of which is finer than portland cement, overlies the sand and clay soil in beds of great thickness near the river but thinning out inland.

Scrape off the surface loam and sod and most of these materials erode easily and quickly. Loess, however, if cut to nearly vertical faces and protected against surface overrun, will stand indefinitely. The material generally lying next below the loess is highly unstable when exposed and has been a frequent source of trouble when exposed in a deep cut through the loess formation.

Outside of the loess regions slopes must be flat and must be protected at once by strip sodding, sprigging or by full sodding. In some districts mulches of hay or pine needles are being used to hold the banks until grass gets a foothold.

In the loess region, the cuts will stand on a slope of $\frac{1}{4}$ to 1, but a characteristic of the material is that its dense nature makes it highly resistant to penetration by sounding rods, and there was no time to dig deep test pits in laying out the present program. Hence, some deep cuts that were supposed to be entirely through loess and were made with steep slopes went down into the unstable underlying clays and these have slumped upon exposure, removing support from beneath the loess causing caving of the banks and making extensive cut widening necessary.

Fills are built with the best of the materials coming out of the cuts or borrow pits, the unstable clays being discarded or mixed with sandy material. Close control is maintained to get the best possible combination of soils and the correct amount of moisture. Fills are built in layers, compacted with sheepsfoot rollers and by the hauling trucks running over them. Fill shrinkage is generally about 25 per cent, but is only 15 per cent in the loess country.

One fill across bottom land subject to long submergence by backwater from the Mississippi River has been built with a slope of 1 on 3 to eliminate the possibility of serious slumps.

Because of the character of the soil the grading operations take in practically the whole right-of-way. Banks are smoothed down and strip sodded, ditches are carefully graded to take water away from the side slopes and fills without erosion. Ditches are made wide and shallow in the cuts, wide shoulders are provided on the fills, and where necessary, chutes are installed to keep drainage water away from the fills.

Where drainage areas are small it is not unusual to find a culvert installed part way up a side slope where a good foundation can be obtained. Where this is done the bottom of the valley is filled with waste material up to the level of the inlet. Similarly, the bottoms of deep isolated pockets are filled to a point where dangerous erosion will not occur and drop inlets are installed.

Side-roads

A notable feature of the grading work is the care that has been taken to give side-roads easy turnouts and long sight distances. Turnouts are paved well back from the main road and the pavement is given a wide throat.

Newly graded roads are opened to traffic as soon as possible to get the addition compaction due to traffic. Where a road is to remain unpaved for some time it is given a 3-in. topping of native gravel which is generally plowed off to the shoulders when the pavement is laid.

Bridges

In addition to numerous smaller structures, four miles of major bridges are included in the present work. Many are across low bottom lands along small streams. The bridges are designed for 15-ton loading and have a minimum clear roadway width of 24 ft. between curbs. Bridges in towns and congested areas have 40 ft. roadways and sidewalks. The curbs are stepped to a height of 20 in. above the floor slab and are heavily reinforced to prevent vehicles from crashing the railing and running off the structure. Pile-trestle construction is used to a great extent except where longer spans are required for major stream crossings. Generally, the trestle work consists of pile bents with caps, surmounted by I-beam stringers that carry reinforced concrete roadway slabs and handrailing. Deck plate girder cantilever spans and continuous steel girders are used for large stream crossings. The longest of these built under the present program is a 375-ft. cantilever unit across Pearl River at Monticello, having a 175-ft. center span with 100-ft. anchor spans, and a 600-ft. continuous steel girder unit across Middle Fork River at Meadville, consisting of six 100-ft. spans.

One of the largest bridges in the present program is across Big Black River near the point where it empties into the Mississippi, and where the flood plane is about a mile wide. This plane is crossed by 3,000 ft. of fill and 2,730 ft. of bridging. The bridge consists of sixty-three 40-ft. spans, two 45-ft. spans, and a 120-ft. through truss. Bents for the trestle spans are of steel H-pile construction, using four piles per bent, 10-in., 42-lb. sections, capped with 10-in. channels with cover plate. The bents

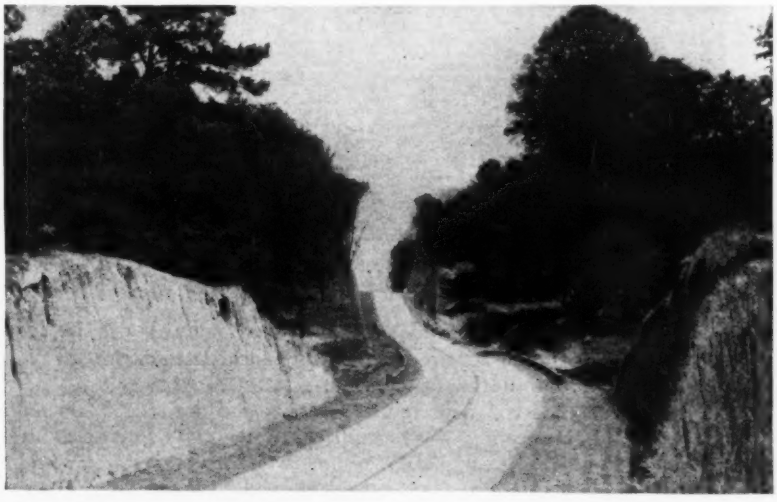


Fig. 4. Unusual care is taken in grading and protecting shoulders and side slopes against erosion. Treatment varies widely in different parts of the state, steep slopes being found best in the loess country along the Mississippi.

Fig. 5. Paving is mechanized extensively and the results are clearly shown in the uniform quality of the finished work.

average about 30 ft. high and pile lengths up to 120 ft. were required, the piles being spliced in the field by electric welding. Electric welding also is used for connecting sway bracing and caps to the steel piles.

Pavement types

High-type pavement, laid generally on the main north and south routes, is either of portland cement concrete or asphalt, the final determination depending on the bid. The concrete pavements are 20 ft. wide, either 9-6-6-9-in. or 7-5-7-in. reinforced with 56-lb. wire mesh. Asphalt pavements also are 20 ft. wide made up of a 7½-in. compacted gravel base, a bituminous prime and a 3-in. asphaltic concrete base course with a modified Topeka surface course 1½-in. thick.

Intermediate types of pavement used on some of the routes include, (a) 4½-in. plant-mixed asphalt on a gravel base using local sand and gravel, surfaced with a ½-in. wearing course in which the aggregate is crushed slag, and (b) a 4½-in. road-mix using local materials where available.

Grading and draining 1,200 miles will cost $18,000,000, or an average of less than $16,000 per mile; major bridges will cost $1,900,000, and right-of-way and miscellaneous items, $2,000,000. Concrete paving averages $22,000 a mile, a total of 770 miles. Asphaltic concrete on compacted gravel base costs $18,000 a mile for 58 miles. Plant-mixed asphalt averaged $12,000 for 26 miles. The road-mixed asphalt (state work only) cost $3,000 to $5,000 per mile.

At the end of the present program, 1,880 miles of the 2,720-mile system will have been paved and 660 miles will be graded ready for paving. There remains 142 miles to be graded. Route No. 49 running south through the state to the resorts along the Gulf Coast has been paved except for 2½ miles, as has Route No. 51 to New Orleans. The cross-state route through Vicksburg and Jackson is complete. Some work remains to be done on the New Orleans-Birmingham route (No. 11) and a considerable amount on the highway along the Mississippi.

Since the first of the year the legislature has authorized an additional bond issue of $40,000,000. Also available are 1938 and 1939 federal-aid funds of $4,500,000, making a total of $44,500,000 to complete the program.

The additional work can be financed out of motor-vehicle revenues as a sharp increase in automobile registrations occurred in 1937 and gasoline taxes collected since the program began increased $2,500,000.

The work is being carried out under the direction of E. D. Kenna, state highway director, executive officer for the highway commission, and R. A. Harris, chief engineer. E. B. Cavallo is construction engineer, G. S. Covert, Jr., J. B. Craig, R. W. Peebles and S. S. Holder, assistant construction engineers, C. S. Hill, bridge engineer, G. A. Draper, research engineer, and S. J. Dalton, maintenance engineer.

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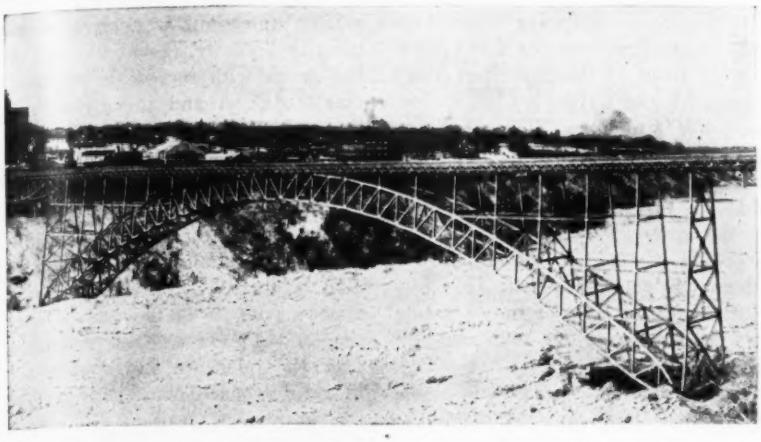
Drought Modifies Flow Record

STORAGE facilities can be used to minimize or even avoid some of the effects of drought upon population and industry, according to the conclusions presented in a recently published report on "The Drought of 1930 in Pennsylvania," prepared by the State Department of Forests and Waters in cooperation with the U. S. Geological Survey. In pointing out this fact, the report states that the topography of Pennsylvania affords unlimited opportunity for adding to storage facilities to augment existing water supplies and to provide new ones. In making estimates of minimum yield from ordinary Pennsylvania streams in former years, 0.1 sec.-ft. or about 65,000,000 gal. per day per square mile of drainage area was considered a safe factor, but knowledge of stream flow obtained in the low year 1930 has given a new yardstick for calculating minimum yield. The report states "We can say emphatically that a figure greater than 0.05 sec.-ft. per square mile could never be used unless very definite information were available for the area being studied."



THE FALLS VIEW BRIDGE SHORTLY BEFORE ITS COLLAPSE

Niagara Arch Memories

by RICHARD S. BUCK
Civil Engineer, Washington, D. C.

At the time of its building, the 840-ft. steel arch recently destroyed by ice had a technical significance comparable with the fame it later acquired

Forty years ago the author of this article was finishing a three-year job as construction engineer on a steel-arch bridge across the Niagara River gorge just below the Falls. Last January 27, this structure, which meanwhile had attained worldwide fame to add to its early significance as the longest steel arch span then in existence, collapsed under an unprecedented jam of ice. Such a notable example of civil engineering deserves an obituary, and no one is as well qualified to write it as the engineer who supervised its construction. A request from Major Buck for such a statement resulted in the accompanying article.

—EDITOR

In writing of the forty-year-old Niagara Falls & Clifton or Falls View Bridge whose 840-ft. steel arch span collapsed a month ago after 36 hours of pounding by an unprecedented ice jam, (*ENR* Feb. 3, 1938, p. 161), I have to rely on recollections much dimmed by time, but I may be able to contribute a little to the understanding of some of the main points of interest in the history of this famous bridge.

Suspension bridges had occupied the site previous to the construction of the arch. In the late eighties the original suspension bridge, a single lane highway structure, with wooden suspended superstructure and cables supported on wooden towers, was replaced by another suspension bridge having a two-lane roadway and a 3-ft. sidewalk. This bridge was supported by four cables, each composed of seven twisted galvanized wire ropes carried over steel towers and attached to eye-bars anchored in the native rock. The stiffening trusses, floor-beams and stringers were steel and the flooring wood. The suspended superstructure was held laterally againt wind pressure by horizontal wire rope cables anchored in rim rock at the top of the gorge; and was held down by a number of guy ropes anchored at the bottom of the gorge to prevent uplift by wind under the floor. The engineers in charge of the design and construction of this bridge were Leffert L. Buck and George W. McNulty of New York.

Shortly after its completion a protracted storm of hurricane force accompanied by sudden drop in temperature tore out one of the wind cable anchorages causing the T-shaped top chord of the stiffening truss to come against the suspenders on the leeward side of the bridge and saw off enough of these to let the entire superstructure drop into the gorge. The towers and cables suffered no damage, and a new suspended superstructure was promptly erected.

When it was decided to provide for trolley cars at this crossing, L. L. Buck was retained to design and supervise the work of enlargement. It was at first proposed to get the additional capacity by widening the existing bridge to provide for two trolley tracks, and to carry the added load on four additional cables. However, after study of all essential factors involved, it was decided that a new steel arch would best serve the purpose, despite the fact that its span would greatly exceed that of any steel arch previously built and require extremely novel erection methods under unavoidably hazardous conditions. I assisted Mr. Buck in preparing the preliminary plans for this work and afterward served as his assistant engineer in charge of fabrication and construction.

In addition to its great length this arch was extremely light for its span, height and carrying capacity. Further, bending moments due to live load had to be taken up by an arch truss only 26 ft. deep. Having no spandrel bracing, the arch was subject to appreciable elastic movement under heavy eccentric live load, although it should be stated that this was not an indication of weakness because the adopted live load and extreme wind pressures were amply provided for. Nevertheless, the prescribed live loads were later materially exceeded because of an increase in the weight of cars and because of the unanticipated use of the bridge as a grand stand from which crowds viewed the illumination of the Falls and other spectacles. The unregulated movements of these crowds sometimes caused marked swaying and alarm but no damage, the danger line probably never being approached. However, to check this disconcerting motion, stiff lateral bracing was later sub-

stituted for the adjustable rod bracing in a number of the bents carrying the flood load to the arch rib. The actual extent of this swaying motion was doubtless far less than it appeared to be to those on the bridge. Swaying under the heaviest wind pressures was never, to my knowledge, marked. I have stood at the center of the span when wind assumed gale velocity without being able to detect undue swaying.

The margin of safety, under legitimate live load and possible wind pressures, was, I am convinced, ample. With proper control of loading, adequate inspection and adjustment of adjustable members and adequate protection against corrosion under the very adverse influence of spray from the Falls, the bridge should have served indefinitely but for the unprecedented ice condition which destroyed it.

Some ice damage previously

As far as I know, only on two previous occasions did the ice encroach on the steel structure in a way to cause damage. In 1899 the ice piled up against the up-stream skewback and bottom chord of the bridge at the American end and bent a few of the light lateral members in the plane of the bottom chords. These were replaced with stiffer members, and concrete walls were built up-stream from and between the skewbacks to check encroachment of the ice. Then in 1908 an ice jam again damaged some of the steel work at the American end, this being repaired, and the members near the skewbacks further strengthened under the direction of Ralph Modjeski, as I was at that time engaged on the Pacific Coast and unavailable. Previously to this time I had made periodical inspections of the bridge, but cannot recall doing so subsequently. It was soon after this that stiff lateral bracing was put in some of the floor supporting bents under Mr. Modjeski's direction. The fatal ice of Jan. 27 apparently was so much worse than any previous jam known as to raise the question as to whether and to what extent this danger may increase in the gorge below the Falls, and to suggest the necessity of providing a more substantial margin of safety for all structures in the bottom of the gorge.

When construction of the bridge was begun the shoreline was several feet in front of the American abutments, but, with the very heavy flow of water from the Niagara Power Co.'s tailrace tunnel, all loose material along the open cut just outside the tunnel portal and in front of the abutments was washed away, exposing the rock formation on which the abutments rest. This formation just in front of theabutments dropped sheer to an undetermined depth.

The proximity, volume and swiftness of the flow of water from the tunnel made it necessary to shift the axis of the new bridge at the American end of the arch about 14 ft. up-stream and to raise the steel work a few feet above the position originally adopted. This mitigated the ice danger slightly although ice did not enter into consideration at that time. Later a heavy concrete retaining wall along the open cut of the tail-race was substituted for a rubble masonry wall built during the initial construction of the arch. This rubble wall had become undermined by the violent force of water in the tailrace.

Shifting the axis and raising the steelwork of the new bridge increased the interference between the old and new structures when the erection of the two ends of the arch approached the center. It was thus necessary to cut away about 200 ft. of the suspended superstructure of the old bridge at the center in order to close the arch. This shut off traffic completely for about three weeks; otherwise traffic was maintained throughout construction without serious interference.

The design of this pioneer long-span steel arch was the bold concept of L. L. Buck, who was given to bold concepts, but its successful realization called for the highest order of skill in detail designing and shop practices and, above all, great courage and care in erection methods. For the successful outcome a large share of the credit is due the contractor for the superstructure, the Pencoyd Bridge Co. especially its chief engineer C. C. Schneider, Paul L. Wolfel, assistant chief engineer, Richard Khuen then job engineer for the contractor, later chief engineer of the American Bridge Co. and John Haupt, foreman of erection. The shop drawings were models of clarity, the shop work was exceptionally accurate, the arch closed at the center with incredible precision, and the novel and precarious erection was accomplished with remarkably few accidents. "The sons of Martha" have rarely done a better job.

Despite severe demands of loading, difficult maintenance conditions and at least two previous serious attacks from ice, the old pioneer rendered a good account of itself in providing pleasure and service, and in earning many times over its cost for the owners. It went down fighting against hopeless odds and without the loss of human life. It has richly earned the right to a worthy successor capable of carrying on through generations to come.

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St. Paul Water Filtration Reaches New Peak in 1936

A NEW PEAK of water consumption, surpassing the previous high of 1931, was reached at St. Paul in 1936, according to the annual report of the Board of Water Commissioners. The amount of water passing through the purification plant (9,355,000,000 gal.) exceeded that of 1931 by 2 per cent and that of 1935 by 17 per cent. In view of the fact that in 1936 the amount of wash water used in the filters was 1.55 per cent of the total going through the plant, as compared with 5 per cent in 1931, the 1936 record is even higher than the per cent increase shows.

The plant reached its peak on July 10 when it delivered 58,400,000 gal., 39 per cent more than its normal capacity of 42,000,000 gal. During the year the plant operated at an average rate of 15 per cent of normal capacity, with a maximum monthly requirement of 87 per cent. The average time between backwashings was 50 hours. In average treatment, the aluminum sulphate was 16.65 p.p.m.; liquid chlorine, 0.90; and ammonia, 0.15 p.p.m. Turbidity was 4 p.p.m. for the influent, 5 for coagulating station effluent, and zero for plant effluent. The colon index was 10.10 for plant influent, 6.48 for coagulating station effluent, 0.95 for filter effluent and zero for plant influent. The character of the water in 1936 demanded a higher chemical treatment than for many years.

Studies of Beach Erosion

by Col. Earl I. Brown

Senior Member, Beach Erosion Board, Washington, D. C.

Satisfactory results in small wave tank leads to construction of larger tank for more elaborate studies of destructive effect of wave action

Encouraging results in determining the probable effect of corrective works in rivers and harbors have been obtained through the use of models, but the more complicated problems arising in maritime regions where waves, tides and ocean currents are contributing factors have not been so completely investigated. Available laboratory technique and model laws relate chiefly to river problems and fluvial flow. For this reason the studies made to date by the Beach Erosion Board have been largely of an exploratory nature. However, they have been so encouraging as indicating the possibilities of adequate research into coastal problems that the board now is engaged in the construction of a large wave tank in the Dalecarlia water reservation in Washington.

The Beach Erosion Board was created by an act of Congress in 1930 for the purpose of making investigations and studies on beach erosion problems in cooperation with appropriate state agencies with a view to devising effective means of preventing erosion of the shores of coastal and lake waters by waves and currents. The duties of the board were amplified by an act of Congress in 1936 to authorize it to conduct investigations of a general nature on beach erosion problems, without cooperation of a state agency, and to require that it publish from time to time such useful data and information concerning the protection of beaches as may be considered to be of general value.

Prior to the passage of the later act, investigations of a general nature and experiments on beach erosion had already been carried on by a special board appointed by the Chief of Engineers. All of the information thus gathered was available to the Beach Erosion Board.

In the United States but little investigation of the causes of beach erosion and the best methods of preventing it had been undertaken prior to 1922. There was little general interest in the subject until the rapid development and popularity of beach resorts called the attention of the public to the fact that the beaches are not permanent in their location, but are subject to damaging erosion and destructive storms. Hotels, dwellings, and places of recreation at beach resorts are usually placed as close as possible to the sea shore without regard to the changes which are continually occurring. Beach resorts are now of serious commercial interest to the coastal states, and the prevention of erosion and stabilization of the developed beaches is necessary. This led the state of New Jersey in 1922 to begin the first serious study of its beach problems.

In its early work the board was confronted with a lack of fundamental data. In order to obtain these, a field party was established at Long Branch, N. J., and remained on the ground for a period of one year making various observations and experiments along the beach and offshore in order to secure basic information on the forces causing sand movement and the effect of this movement on the beaches. Much valuable information was secured, but observations offshore, particularly during storm periods, were generally unsatisfactory. For example, a substantial pier projecting to moderately deep water in the ocean is required to obtain the data, yet the presence of the pier may cause currents that will modify and invalidate the results obtained.

In view of the great expense and difficulty of obtaining reliable observations in the field, the board early considered the advisability of constructing a wave tank in which a model beach could be subjected to any desired variation of attack by model waves, tides, and currents. There was little information of laboratory experiments dealing with ocean phenomena upon which to base preliminary design. With a full realization that the data obtained from a model wave tank would be largely qualitative and not quantita-

Fig. 1. Beach erosion is costing coast cities hundreds of thousands of dollars annually.

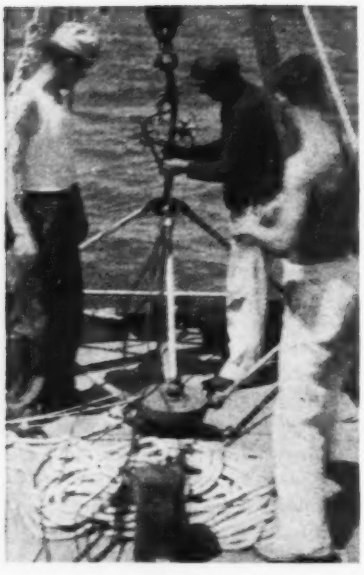


Fig. 2. Field conditions are studied by lowering current meters to the ocean bottom.

tive, and that the results must be checked by field observations before full reliance could be placed upon them, the board felt that many data could be secured concerning the evolution of sandy beaches which could not be obtained otherwise. There was in the board's office or readily available through the U. S. District Engineer offices and the U. S. Coast and Geodetic Survey a vast amount of information and survey data from all parts of the coasts of the United States which it was believed would assist in evaluating the results obtained from a wave tank. New field data are continually being accumulated in the board's office from new cooperative beach erosion studies.

An experimental tank was constructed at Ft. Belvoir, Va., during the summer of 1932. It consisted of a concrete basin 12x24 ft., 3 ft. deep. At each end was a pit 2 ft. wide and 1 ft. deep, through which the water supply could be introduced by a perforated pipe controlled by a valve. Water could be supplied at either or both ends simultaneously. Along one side was a stilling basin 1 ft. wide and 4 ft. deep, open to the tank at both ends and containing the drain for the tank. The supply lines entered the tank through the end walls and limited the effective depth to which the tank could be filled to 18 in.

Waves in the tank were produced by a plunger-type wave machine. An electric motor moved the plunger up and down in the water. The angle at which to set the face of the plunger was determined by visual observation of waves produced by various settings. After considerable experimentation, it was decided that an angle of 50 deg. from the vertical produced the best waves and this was used in the experiments. The speed of the plunger, determining the wave period, was regulated by a rheostat, and the volume of water displaced, which affected the wave height, was regulated by adjusting the length of stroke. Wave heights in the tank were measured by means of a combined hook and point gage.

Compensation for tides

A tidal apparatus similar to a water stage recorder was developed to regulate tidal heights in the tank. A float in a well damped to eliminate wave action was connected through a flexible wire fastened to the smaller sheave of a differential pulley. Another wire fastened at one end to the larger sheave of this pulley with counterweights at the outer end operated a pointer. The diameter of the larger sheave being twice that of the smaller, the pointer had twice the movement of the float. Typical tidal curves were plotted from the mean of tides at Long Branch, N. J., and indicated on a drum which was rotated in front of the float pointer by means of a clockwork. The operator, by proper manipulation of the intake and discharge valves, could keep the pointer on the plotted tide curve.

Scale determination

Before any investigations of sand movement could be undertaken, it was necessary to determine something about the model scales to use. A study of the reports on known model experiments on sand movement along open beaches failed to show any logical time or distance scale. The model laws used in hydraulic laboratories in the study of fluvial flow did not appear applicable, and so a considerable number of preliminary experiments were necessary in order to arrive at a scale which seemed suitable to the operations to be conducted in the wave tank.

From observations in the field it was found that the size of sand particles has a fairly close relationship to the slope of the foreshore. During calm weather, with sand of a given size the slope of the foreshore remains fixed within reasonable limits. An attempt was made to use this relationship to correlate the slope of the foreshore obtained in the tank with that in nature on beaches composed of sand of approximately the same median diameter as that used in the tank. The tests showed that the slopes in the tank were steeper than those in nature, indicating that instead of an undistorted scale it should be distorted with a ratio of horizontal to vertical something greater than unity. No definite determination of this ratio was possible at the time, and the question of scales was then approached from a different angle.

Time scale determined

The time scale then was considered, and a comparison was made between the wave action and period in nature and in the tank. A great many observations of ocean waves and their periods had been made at Long Branch, N. J. Waves there varied from a maximum of ten in 2 min. to a minimum of ten in 40 sec., corresponding to wave periods of 12 sec. and 4 sec. respectively. Observations in nature showed that the slow waves struck the beach, rushed up the foreshore and returned to the plunge point before the following wave struck the beach. Rapid or storm waves in nature were observed to break before the preceding wave could reach the top of its uprush and return to the plunge point. The wave machine was operated through a great variety of speeds and depths of plunge and it was observed that waves generated in the tank at a rate of 25 per min. produced the same effect of backwash meeting the oncoming wave at the plunge point as the slow or normal weather waves in nature. Also, waves generated at a rate of 45 per min. had the same general appearance on the beach in the tank as fast or storm waves did in nature. A comparison of these times in the model with the corresponding times in nature gave a time scale of 1 to 3.

A vertical scale was obtained by comparison of the height of the model waves at 25 and 45 waves per

minute with normal and storm waves in nature and in each case the ratio was 1 to 24. With the time and vertical scale determined as described above, Froude's law for model scale, $T\frac{1}{d}$ gives a horizontal scale of 1 to 14.7. Measurement of beach slopes in the tank give a rough check on this, in that the slopes were nearly twice as great in the tank as in nature.

Experiments

The first four experiments in the tank were made with a constant still-water level and varied wave attack against the beach to determine what could be learned of the mechanism of a suspected on and offshore movement of sand. It was found that under rapid wave action, simulating storm conditions, the beach was eroded and there was an offshore movement of this sand and of the bottom sand and the formation of offshore bars. The tank bed was left in this condition and wave action reduced to simulate normal wave condition. Under this slow wave action the direction of sand movement was reversed, the bars remained intact but were moved bodily shoreward until they joined the beach.

The tests mentioned above were repeated with the added factor of storm and normal tides. The general results were the same as to direction of sand movement. Under storm tides and waves, however, the bars were much less pronounced and were so far from shore as to be under the immediate disturbance of the plunger. This was the first indication that the tank should be longer in order to assure sand movement in the offshore areas undisturbed by the plunger turbulence. Normal and storm tides were included in all subsequent experiments.

The next series of tests was made to determine the effect of a vertical bulkhead at mean high water on the movement of beach sand. The beach was formed roughly on the slopes resulting from normal wave action in previous tests and was then subjected to a considerable period of normal waves and tides. When the beach appeared stable a vertical bulkhead was placed at the high water line and the results of storm and normal wave action were observed. The storm waves resulted in a much more rapid and extensive erosion of the beach in the immediate vicitinity of the wall. Storm action was stopped when the erosion had reached a point which endangered the wall. A return to normal resulted in a building of the beach to approximately the same elevation as it was originally.

The next investigation was to determine the possibility of forming a barrier beach under wave action normal to the shore. It was found that a complete barrier with lagoon area in rear and a tidal inlet could be formed by normal wave action. The requisite conditions for this to occur were a long very shallow offshore which may very possibly have existed during the glacial periods when large areas of the continental shelf were probably exposed.

Following these experiments it was decided to test more fully the different types of wave generators which had been used by other investigators with a view to determining which type was best suited to laboratory work. The following types were tested—plunger with variable face, gate type fastened at bottom, pusher, eccentric roller and paddle wheel. The investigation consisted in securing data on the wave form, velocity, and the orbital movement of water in the wave. The results so far indicate that the plunger type with an angle of the face about 60 deg. produces the best wave. These results must be checked, however, in the board's new tank where the waves can be given a greater run in comparatively deep water.

No attempt will be made here to discuss in detail the various series of experiments but they are mentioned above to show the gradual development of the board's wave tank work. These first experiments are

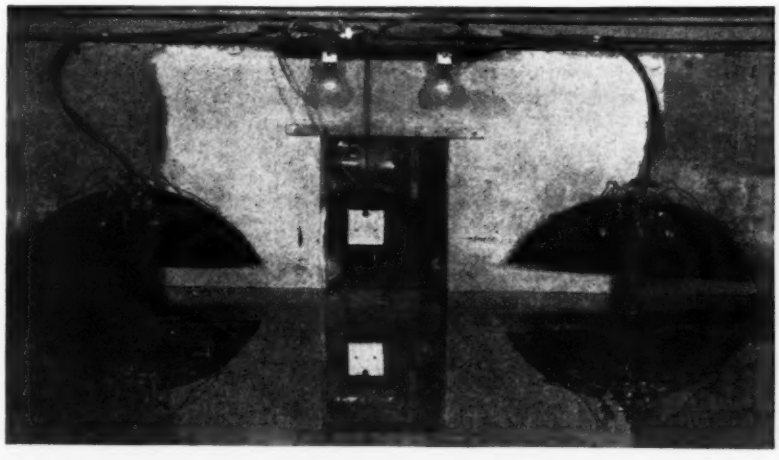


Fig. 3. Apparatus developed for measuring wave characteristics in the tank studies.

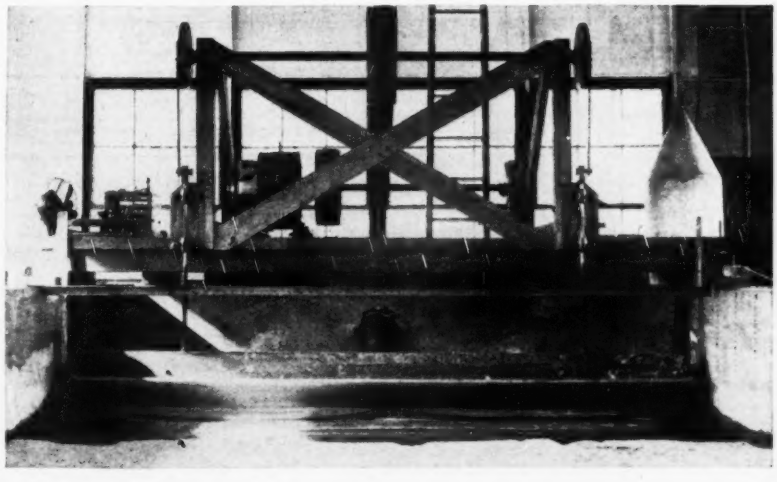


Fig. 4. The plunger type of wave generator was found to be most satisfactory.

regarded as valuable not only for the results obtained but particularly so as to to the lessons learned on wave tank technique, and the development of special apparatus and instruments for measuring sand movement and wave characteristics. A 16 mm. moving picture camera was found to be of inestimable value in recording certain phenomena and permitting their study in greater detail by slow motion or still projection.

Wave Tank Built at Washington

Large tank designed from experience gained in beach-erosion studies made on small tank

THE EXPERIENCE gained in the wave tank at Ft. Belvoir has proven most valuable in the preparation of a design for a new wave tank now under construction at the Dalecarlia water supply reservation in Washington. The general plans for this tank are shown in Fig. 1. The principal changes and improvements over the old tank are: a large increase in size, much greater flexibility of water circulation, the inclusion of windows along the side of the tank, and an automatic tide-regulating apparatus.

The increase in length of the tank from 24 ft. to 85 ft. was considered essential in order that the waves produced might have a sufficient run, before striking the beach, to rid themselves of the turbulence and internal disturbances caused by the plunger in forming the wave. The waves in the old tank showed plainly the effect of plunger disturbances and drag on the shallow bottom. In the new tank it is intended to give the waves a considerable run in relatively deep water before they are affected by the sloping bottom in order that they may assume more natural characteristics. The new tank is 2 ft. wider and will have an effective depth of 3 ft., twice that in the old tank.

One of the major improvements in the new tank is the flexibility of the water circulation system. The supply line comes into the tank through a control pit at the front of the building. Two 6-in. water lines are placed on each side of the tank immediately under the side walls of the tank with risers every 12 ft. into recesses in the tank wall. These risers are normally to be kept closed and the water passed down either or both sides of the tank and admitted to the tank through distributing pipes in the bottom of the well at the plunger end. The distributors are designed to provide uniform flow into this distributing pit by increasing the size of the discharge orifices from the junction with the supply line outward into the pit. Two such distributors are provided, and either or both may be used from either side main. After the tank has been filled to the desired depth from the city

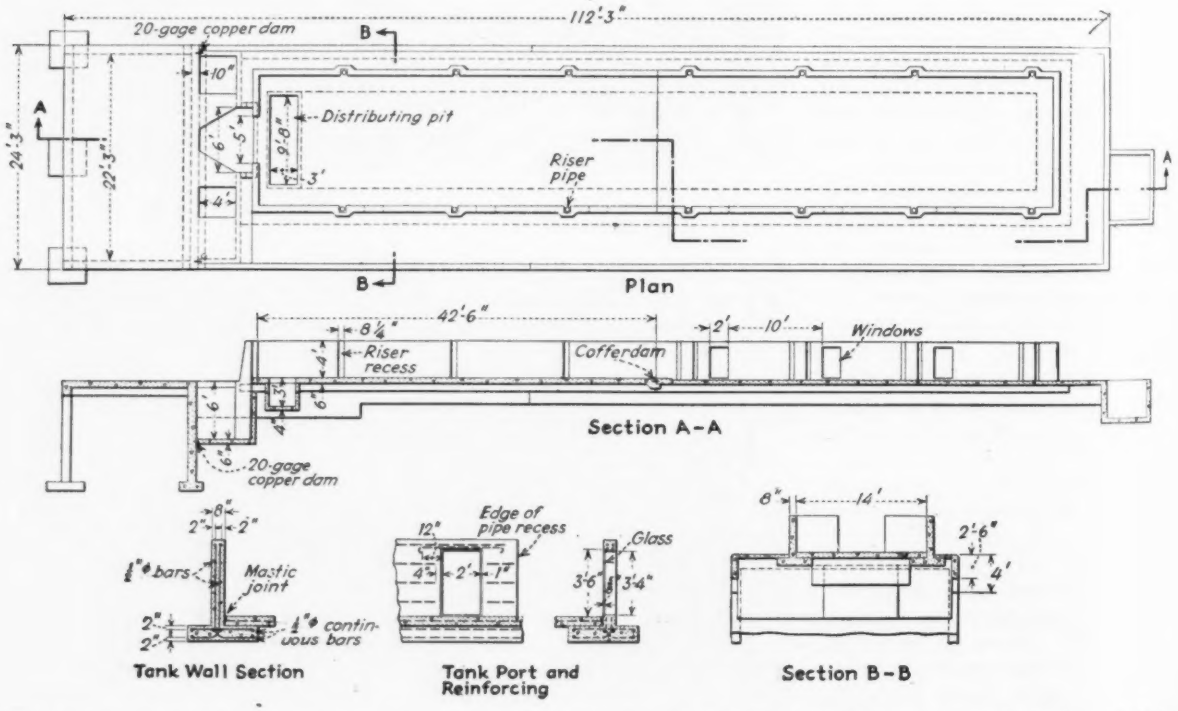


Fig. 1. The wave tank now under construction is much larger than the Ft. Belvoir tank and will provide much more flexibility in conducting erosion studies.

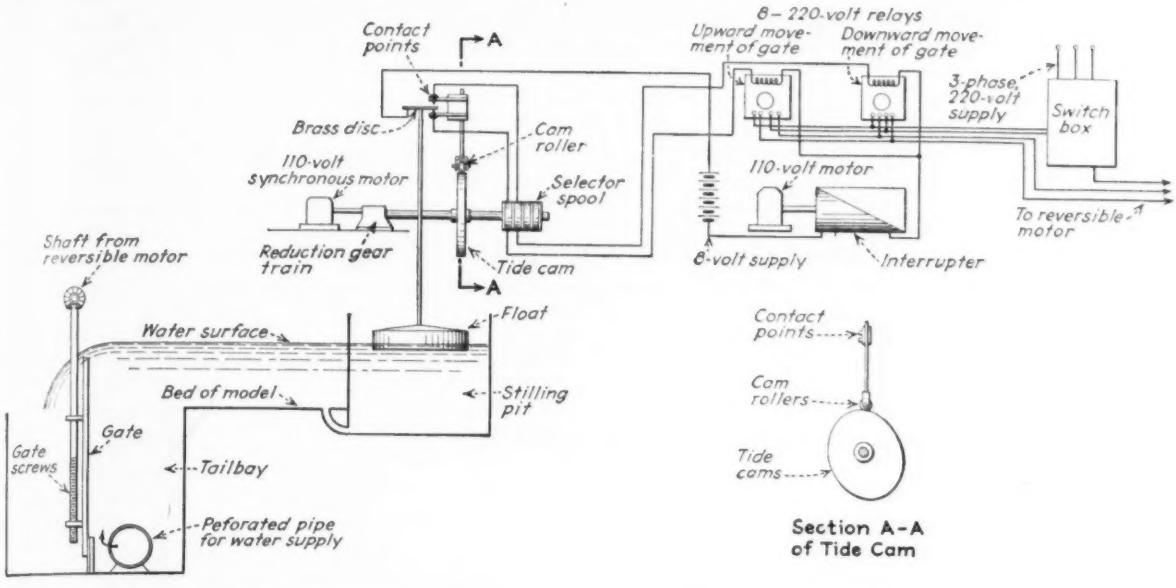


Fig. 2. Diagramatic arrangement of the tide-gate control in wave tanks.

water supply and some surplus water allowed to flow over the tide gate to the sump beneath the wave machine, the supply line may be closed and the same circulation of water secured by means of a pump located in the basement, thus conserving a considerable amount of water by recirculating it.

A littoral current may be secured in either direction and at any desired angle to the beach by flowing water into the tank through any of the risers in the wall recesses and discharging from the tank through other risers. The two side mains can be conveted into inlet or discharge lines by opening or closing certain valves. The flow into the wall recesses may be either from the main supply or from the sump by means of the pump.

The inside of the tank wall is kept smooth by plates across the recesses in order that there may be no interference with wave propagation. These plates will be so arranged that the inlet or outlet to the recess may be varied vertically by 1-in. increments to accommodate any bottom slope and to admit or discharge water at any desired elevation. The recesses with orifices near the bottom will be useful also as stilling basins to check the still-water level along both sides of the tank; ¾-in. pipes are set into the recesses for that purpose. As a future development it is expected to connect these up to a multiple recording instrument which will show water elevations along the sides of the tank at all times.

The insertion in the new tank of windows on the side is a result of the experiments in the old tank. After the moving picture camera was first used in the old tank it was evident that a great deal of valuable information could be secured if pictures could be taken through the side wall. A window was cut through the wall of the old tank about 9 ft. from the plunger and was used very effectively in photographing wave characteristics in the last experiment. The new tank is being equip- 10-ft. intervals. It is expected that they will assist materially in future ment and wave characteristics.

The tide-regulating mechanism for the new tank is automatic. It is a slight modification of the type first developed in Germany and later used at the Vicksburg Hydraulic Laboratory. A float, in a stilling well connected with the tank, makes an upper and lower contact on a cam cut and rotated to conform to any given tidal cycle. When the upper contact is made, the tide gate is lowered by a motor to allow more water to pass over it into the sump thus lowering the water in the tank. When the lower contact is made the motor causes the gate to rise and allow less water to pass over. These contacts are so close together that there is an almost constant adjustment up and down of the gate to conform to the proper water elevation in the tank for the phase of the tide. The supply of water into the tank, either through the distributing pit above or in combination with littoral flow through the side recesses, is constant, and the up-or-down movement of the tide gate conforms to the adjustment of the tide gate. By this mechanism the still-water elevation in the tank for all stages of the tide can be controlled to within less than 0.01 ft.

For the preliminary experiments with the new wave tank, the offshore bottom will be struck on a very gradual slope from the floor about 30 ft. in front of the plunger to the point where the foreshore slope begins. The foreshore will be on a 1 to 10 slope to a point well above storm wave action and from the top of the slope the sand will be carried to the back wall horizontally about 10 ft. The waves will thus have a run of about 30 ft. in water which, at the vertical scale of 1 to 24, will represent depths of between 50 and 75 ft. in the ocean before they reach the sloping bottom. A natural beach sand will be used.

In forming the beach before beginning an experiment the same procedure will be used as followed in the old tank. With the artificial beach and offshore slopes described above, the beach will be washed with calm weather waves normal to the beach until it assumes natural slopes and appears stable. With the old tank this required about ten to sixteen hours.

When the new wave tank is placed in operation the first work to be done will be a check of the results of experiments in the old tank on sand movement on and off shore under wave action normal to the beach. The work in the new tank will for the present be confined to fundamental research, and no investigation or model studies of specific local questions will be undertaken until the Beach Erosion Board is satisfied with the basic investigations.

The board, with its large amount of factual data on conditions at many points along the coasts of the United States and its experience in the operation of the old wave tank, is now in position to give valuable assistance to colleges and universities desiring assistance in undertaking demonstration or research model studies of maritime problems. A committee of the board has recently prepared a list of demonstrations which can be used in undergraduate instruction and a second list of subjects which will require further research, corresponding to graduate work. These lists, together with information upon natural conditions at specific localities, and advice on wave tank design and equipment, can be furnished colleges and universities upon request. Under existing regulations it will be necessary to require payment for the cost of reproducing or securing the data requested on natural conditions. If the data are available in the board's office, this charge for reproduction will be very little.

Home-Made Shop Aids

IN THE MACHINE SHOP at the Pasadena Water Department's pipe yard there are three home-made pieces of equipment which speed up and simplify the operations required of a general repair shop. These items are (a) a two-compartment bin on wheels for picks that come in to be sharpened, (b) a sheet-metal rack also on wheels which serves both for storing sheet-metal and as a cutting and assembly bench and (c) a very heavy metal table used for many operations that otherwise would have to be performed on the floor or on the limited space available on the anvil.

The bin for picks is about 2x4 ft. in plan and 30 in. deep. It is mounted on casters so that it can be wheeled to the door of the shop when a truck load of equipment brought into the yard includes picks to be sharpened. It has two compartments so that the dull picks can be kept on one side of the central partition. After they are sharpened and put in serviceable condition they are returned to the bin but are stored on the opposite side of the partition from those still awaiting attention. When the picks are transferred to the warehouse or are taken directly from the forge to a truck, the portable feature of the bin again is used.

The sheet-metal rack is 5x10 ft. in plan, and 26 in. high so it will be at a convenient working level. The top is surfaced with ¼-in. sheet-metal to make it useful for fairly heavy work particularly in cutting and assembling sheet metal jobs. By putting in shelves, the space beneath the top is made useful for storing sheet-metal; a total of 6 shelves are provided. The 6 castors, which are 5 in. in diameter, are handy for moving the rack back out of the way when not needed, or for turning it to enable workmen to take advantage of light or other working conditions.

The heavy metal table consists of the circular crank and shaft from an old Corliss engine. Salvaged from the scrap heap where it was valued only as so much junk metal, it was set up in the shop with the 6-ft. shaft projecting down into a pit; concrete poured around the shaft gives it rigid support. It was set with the surface of the circular top 29 in. above the floor level. The 40-in. diameter affords an area large enough to give considerable working space; in fact, this space is chosen as a working table more often than any other place in the shop. At the flange, the wheel is about 5 in. in thickness, although the thickness is only 2 in. over most of the table top area. For convenience in bending pipe and other similar operations a wide groove was machined around the periphery of the wheel before it was mounted.

The Pasadena Water Department is operated under the direction of Morris S. Jones, chief engineer and general manager.

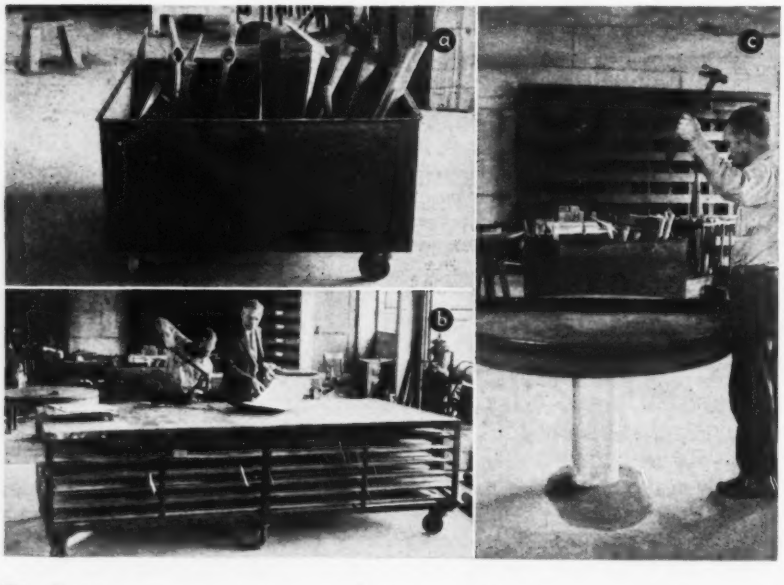


Fig. 1. Home-made conveniences in Pasadena's pipe yard shop include: (a) a portable bin for picks, (b) a sheet metal rack on wheels and (c) a heavy metal table.

More On Salvage From Sewage

by J. H. GARNER

Chief Inspector, West Riding of Yorkshire Rivers Board, Wakefield, England

Experiences in England point to wider use of sludge for fertilizer and the desirability of grease recovery

The following observations by Mr. Garner, submitted by invitation of Engineering News-Record, *furnish a valuable commentary on sewage by-product recovery. As chief inspector of the West Riding of Yorkshire Rivers Board, an agency of 45 years standing which has under its jurisdiction about 450 treatment plants, he is eminently qualified to report on current thinking in his country. The reader is also referred to a letter by H. C. Whitehead, engineer of the Birmingham (England) District Drainage Board published in* ENR *Jan. 27, 1938, p. 132.* —EDITOR.

THE WHOLE HISTORY of sewage disposal is interspersed with ideas of "profitable utilization," ranging from direct application to land, to intricate processes for the recovery of more or less valuable byproducts. Indeed, what concerned many of the earlier advocates of chemical precipitation processes was the question of obtaining a greater return rather than producing a better effluent. Experience and the necessity of complying with recognized standards of purification have made us less mercenarily inclined nowadays.

It is opportune, however, that once again attention should be redirected to the utilization of sewage as distinct from its disposal, and Dr. Willem Rudolfs is to be commended for having so concisely summarized the present-day aspects of this important question in his recent article on "Salvage from Sewage." (*ENR* Dec. 30, 1937, p. 1055. Dr. Rudolfs has perhaps put things in proper perspective—and the writer is in agreement with him—when he asks whether the time has not come to search for methods which will conserve and utilize more of the by-products obtainable from sewage, and whether that search may not result in new procedures for treatment in which disposal will be only incidental to recovery.

To deal adequately with the present and suggested uses of sewage mentioned by Dr. Rudolfs would require a book of no mean size. As he says, the trend for utilization is perhaps greater than generally realized. It is therefore to be hoped that those who, as the result of their investigations and experiences, have acquired specialized knowledge will make that knowledge more widely available.

In a paper by the writer on the utilization and disposal of sewage sludge (*Proc.* Assn. Managers of Sewage Disposal Works, 1918, p. 80) opinions were expressed parallel with some of those advanced by Dr. Rudolfs, particularly as regards the destruction instead of conservation of organic matter resulting from certain methods of sewage treatment. In this connection there was described a process for the recovery of grease and fertilizer from sewage sludge which has been in operation at Huddersfield since 1915.

The first essential in the better utilization of sewage constituents obviously lies in their removal in the freshest possible condition, thus demanding that attention be given to complete and rapid clarification and removal of the deposited solids (sludge) with the least possible delay. What processes may be adopted towards this end are, of course, largely dependent upon the character of the sewage to be treated.

I have been interested to compare the report recently issued by a committee of the American Public Health Association on the use of sewage sludge as fertilizer with that of a committee of the National Salvage Council (England) issued in 1919. The latter committee was appointed to consider and report on the further utilization of sewage sludge from the point of view of: (1) the recovery of marketable grease from sewage sludge; and (2) the preparation of a fertilizer or fertilizer base from sewage sludge. Both reports agree that sewage sludge is of value as a fertilizer, if properly prepared and applied. It is in overcoming the difficulties and the initial expense involved in this preparation and application that greater enterprise is needed. In England, experience is increasingly proving that when sewage sludge is made available as a proper marketable commodity there is a ready and remunerative sale for it.

It is generally agreed that the presence of much grease is detrimental to the use of sewage sludge as fertilizer, therefore where the amount of grease is abnormally high its separate recovery may not only be desirable but economically justifiable, as at the Bradford, Halifax, Huddersfield and Morley sewage treatment works. In normal cases digestion now affords an effective and economical means of eliminating grease, at the same time converting the greater proportion into utilizable gas. What is still required in connection with the digestion process, in my opinion, is a supplementary mechanical process to avoid all handling and to reduce the digested material to a dry portable condition marketable as a fertilizer.

At the risk of appearing reactionary, there is much to be said even yet in favor of sludge pressing under proper conditions and with well-designed plant, preferably in conjunction with a mechanical process for further drying the pressed material. Also, as an alternative to digestion, one must not lose sight of the progress which is being made towards perfecting methods of chemical conditioning and rapid mechanical dewatering and drying of sludge. There are great possibilities in this direction, and mechanical processes for dealing quickly with *fresh* sludge seem to offer better prospects of a wider use of sludge as a manure.

It is my hope that Dr. Rudolfs' article, by focussing attention on the very important question of sewage utilization, will stimulate research in the directions indicated by him and eventually lead to the satisfactory and economical salvage of those potentially valuable constituents of sewage which are undoubtedly being wasted at present.

BOOK NOTES AND REVIEWS

The month's additions to the engineer's reading and reference list

Principles of Indeterminacy

THEORY OF STATICALLY INDETERMINATE STRUCTURES — By Walter M. Fife and John B. Wilbur. First Edition. 248 pp. Published by McGraw-Hill Book Co., New York and London. Price $3.50.

Recognizing the validity of the criticism that the classic methods of analysis for indeterminate structures often involve excessive labor, the authors of this new text nevertheless maintain that only by familiarity with these methods can one acquire understanding of indeterminate structure behavior and utilize short cut methods intelligently. Accordingly, the book begins with a chapter on basic concepts and theorems and takes up in turn deflections, stress analysis, and influence lines, all considered in the light of the basic laws of Clapeyron, Castigliano, Maxwell and Mohr. The concluding chapter covers secondary stresses in trusses.

The Kaskaskia Valley

PHYSICAL, ECONOMIC AND SOCIAL ASPECTS OF THE VALLEY OF THE KASKASKIA RIVER—Vols. I and II. By University of Illinois and certain state departments. 300 pp. Published by University, Urbana, Ill. Free to interested parties.

Some 23 topics are discussed by specialists with conclusions and suggestions on economic and social applications. For instance, the chapter on soils is understandable to dirt farmers and engineers. Relative values are given in simple understandable terms. The author mentions the important relationship, not only of fertility of soils but their water receiving and holding characteristics. Comments by authors of the chapters on water supply, reservoirs and flood control enables the subject matter to be readily correlated with population distribution and human needs. Other chapters relate to geology, climatology, mineral resources, stream pollution, power, rural electrification, transportation, land use, soil erosion, forestry, recreation, fish and game, population, social welfare, health, education, industry and trade, weather indices and agriculture. The report which is in no sense a plan for the development of the valley was prepared by many agencies whose work was coordinated by W. C. Huntington, head of the Department of Civil Engineering, University of Illinois.

Planning Parkways

PARKWAYS AND LAND VALUES—By John Nolen and Henry V. Hubbard. 147 pp. Published by the Harvard University Press, Cambridge, Mass. Price $1.50.

This eleventh volume of the Harvard City Planning Studies will particularly interest all persons having any part in the growth and planning or replanning of modern communities, for in such planning a parkway is no longer to be considered as a mere circumferential pleasure drive but rather as a modern highway providing quick, pleasurable, safe driving between home and work.

To fit the parkway into its proper niche in modern community planning, the authors have studied the functions, costs and resulting benefits of the Metropolitan Boston, Kansas City, and Westchester County parkway systems. These three selected examples provide an excellent cross-section of the parkway problem, differing widely as they do in age, geographical location, topography and methods of financing. A very definite picture of what a parkway is and does is painted by a detailed description of all features of the three systems.

With this picture painted, however, there still remains the difficult task of evaluating the effect of parkways on abutting and non-abutting lands. How can the effect of the parkway be segregated from the many other valuation-defying influences on land values? What is land value—is it really the assessed value? Should the variation of the purchasing price of the dollar be included? What areas and what persons benefit in what degree from the construction of a parkway? These are but a few of the questions that lead one to believe an answer is impossible; but by selecting a small representative section from each of the parkway systems and then subjecting that section to a critical unbiased study, the authors have succeeded in providing general answers to these questions as well as indicating methods for evaluating the effect of parkways on land values.

Their comprehensive summary which relates how parkways have been administered, fitted into regional plans, designed, regulated, what they have cost, how assessments have been made, and finally what their economic effects have been, will benefit all communities faced with traffic problems.—*Reviewed by* HENRY P. EVANS, *Civil Engineering Department, University of Illinois, Urbana, Ill.*

Detroit Traffic

STREET TRAFFIC — CITY OF DETROIT, 1936-1937—313 pages. Prepared and published by the Michigan State Highway Department, Detroit, Mich.

This large book is the first published report of the Highway Planning Survey being conducted by the Michigan State Highway Department in cooperation with the Detroit Police Department and the Works Progress Administration. In addition to the physical and historical aspects of the traffic problem, the report covers the closely integrated questions of parking and highway safety.

The fan shape of the city with the focal point of the central business area adjoining the river makes distances to the outskirts of the city longer than in other cities of corresponding size. The report shows that there are insufficient ringing streets to detour through traffic around the central district. Also, a cross movement of heavy commercial traffic at hours coinciding with the peak of passenger traffic complicates an already bad situation. Other factors affecting the problem are: location of freight and loading districts in the very central part of the city, thus necessitating the movement of commercial vehicles through the central business area; parking in congested areas; loading and unloading of street cars; congestion caused by the

simultaneous working periods in factories in concentrated industrial districts; and bad intersections. While these are common to many cities, they appear in an exaggerated form in Detroit. The report concludes with recommendations for eliminating difficulties due to the intersections and provision of additional circumfrential streets, designation of one-way streets in some areas, and the establishment of parking lots in areas outside the business district with frequent bus service from them to the downtown section. — *Reviewed by* FRANK LEE COCHRAN, *Evanston, Ill.*

MISCELLANEOUS NOTES ON BOOKLETS AND REPRINTS

THE PROCEEDINGS OF THE 23D ANNUAL ROAD SCHOOL, Purdue University, Extension Series No. 39, Engineering Extension Department, Lafayette, Ind. Free, subject to certain restrictions.*** THIRD PROGRESS REPORT of the Joint Investigation of Fissures in Railroad Rails; Reprint No. 11, Engineering Experiment Station, Urbana, Ill. Price, 15c.***YEARBOOK OF RAILROAD INFORMATION, 1937 edition, published by the Committee on Public Relations of Eastern Railroads, 143 Liberty St., New York City.*** TESTS ON STEEL COLUMNS, Thin Cylindrical Shells, Laced Channels and Angles; Bulletin 292, (Price, 50c.) THE COMBINED EFFECT OF CORROSION and Stress Concentration at Holes and Fillets in Steel Specimens Subjected to Reverse Torsional Stresses; Bulletin No. 293, (Price, 50c.) TESTS ON THIN HEMISPHERICAL SHELLS Subjected to Internal Hydrostatic Pressure; Bulletin No. 295, (Price 30c.), all three from Illinois Engineering Experiment Station, Urbana.*** FIRE RETARDANT ROOFING; National Fire Protection Association, 60 Batterymarch St., Boston. Price, 10c.*** PERTINENT QUESTIONS AND ANSWERS CONCERNING DUST; Mine Safety Appliances Co., Braddock, Thomas & Mead Sts., Pittsburgh, Pa.*** SOLUTION OF THE ELASTIC CURVE EQUATION; Engineering and Science Series No. 54, Rensselaer Polytechnic Institute, Troy, N.Y.*** SOME PROPERTIES and Tests of Traffic or Zone Paints; Research Paper RB1007, National Bureau of Standards, Washington, D. C.*** THE WATER-JET PUMP: A reprint from University of California Publications in Engineering, Vol. No. 3, University of California Press, Berkeley, Calif.*** PROPERTIES OF CEMENTS AND CONCRETES Containing Fly Ash; American Concrete Institute, Detroit, Mich.*** THE DROUGHT OF 1930 IN PENNSYLVANIA: Department of Forests and Waters Division of Hydrology, Harrisburg, Pa.*** STUDIES on the Manufacture of Insulating Board (Bulletin 136). CORNSTALK ACOUSTICAL BOARD (Bulletin 137); Iowa Engineering Experiment Station, Iowa State College, Ames, Iowa.*** PROBLEMS IN BUILDING ILLUMINATION, Circular No. 29, Engineering Experiment Station, University of Illinois, Urbana, Ill. Price, 35c.

NEW PUBLICATIONS

JOHN PHOENIX, ESQ.—A Life of Capt. George H. Derby. By George R. Stewart, Jr. 242 pp. Published by Henry Holt and Co., New York. Price $2.50.

ELEMENTARY SURVEYING—Seventh Edition. By Charles B. Breed and George L. Hosmer. 717 pp. Published by John Wiley & Sons, Inc., New York. Price $4.

PROCEDURE HANDBOOK OF ARC WELDING DESIGN AND PRACTICE—Fifth Edition, 1938. 1012 pp. Prepared and published by the Lincoln Electric Co., Cleveland, Ohio. Price, $1.50 in U.S.A., $2 elsewhere.

BAUFORSCHUNGER: DIE AUSTROCKNUNG VON MAUERWERK—By Rudolf Dittrich. 156 pp. Published by Rudolf Muller, Eberswalde, Germany.

REPORT ON PROGRESS OF THE WORKS PROGRAM—December, 1937. 112 pp. Prepared and published by the Works Progress Administration, Washington, D. C.

STAGES AND DISCHARGE OBSERVATIONS; LOWER VALLEY OF THE MISSISSIPPI RIVER—January 1 to June 30, 1937. 53 pp., 8 maps. Compiled and published by the Office of the President, Mississippi River Commission, Vicksburg, Miss. Price $4.

THE MAKING AND TESTING OF PLAIN CONCRETE—By George Troxell and Harmer E. Davis. 148 pp. Obtainable from the authors, University of California, Berkeley, Calif. Price $1.75.

GEORGE WESTINGHOUSE—A Forum Presenting the Career and Achievements of George Westinghouse on the 90th Anniversary of his Birth. 78 pp. Published by the American Society of Mechanical Engineers, New York.

SCHRIFTTUM UBER BODENMECHANIK—By Hans Petermann and Elisabeth Boedeker. 196 pp. Volk und Reich Verlag, Berlin.

MOTOR-VEHICLE TRAFFIC CONDITIONS IN THE UNITED STATES—A Report to the Secretary of Agriculture, in six parts. 254 pp. Published as House Document No. 462, by the Superintendent of Documents, Washington, D. C. Price on application.

ELASTICITY STRUCTURE AND STRENGTH—Part II, Philosophy, Natural vs. Sophistical—By Dr. C. A. P. Turner. 82 pp. Obtainable from the author, 964 North High St., Columbus, Ohio.

A COMPREHENSIVE CITY PLAN FOR FLINT, MICHIGAN—Part I: Traffic Survey and Thoroughfare Plan. 70 pp. Published by Flint Institute of Research and Planning, Flint, Mich.

A STATEMENT OF ACCOUNTING PRINCIPLES—Prepared by Thomas Henry Sanders, Henry Rand Hatfield, and Underhill Moore. 138 pp. Published by American Institute of Accountants, 135 Cedar St., New York. Price 77c.

THE CONSTRUCTION OF MAIN SEWERS—By C. G. Kent, assisted by J. C. Morris. 286 pp. Published by Longmans, Green & Co., New York. Price $8.

HANDBOOK OF SCIENTIFIC AND TECHNICAL SOCIETIES AND INSTITUTIONS OF THE UNITED STATES AND CANADA—Bulletin of the National Research Council, No. 101, Third Edition. 283 pp. Published by the National Research Council, Washington, D. C. Price $3.00, paper, $3.50, cloth.

LANDSLIDES AND RELATED PHENOMENA—A Study of Mass-Movements of Soil and Rock—By C. F. Stewart Sharpe. 137 pp. Published by the Columbia University Press, New York. Price $3.

RECORD OF WELLS IN KINGS COUNTY, N. Y.—Prepared by the U. S. Geological Survey in cooperation with the Water Power and Control Commission. 175 pp. Published by the commission, Albany, N. Y.

SIMPLIFIED METHODS FOR COMPUTING STRESSES IN RIGID FRAME BUILDINGS—By Sheldon A. Keast. 40 pp. Published by Lefax, Inc., Ninth & Sansom Sts., Philadelphia. Price $1.

EINGEBETTETE ROHRE—By Dr. Adolf Voellmy. 151 pp. Published by A. G. Gebr, Leeman & Co., Zurich and Leipzig. Price 10 Fr.

FROM FIELD AND OFFICE

Working problems and time-saving methods . . . Edited by Charles S. Hill

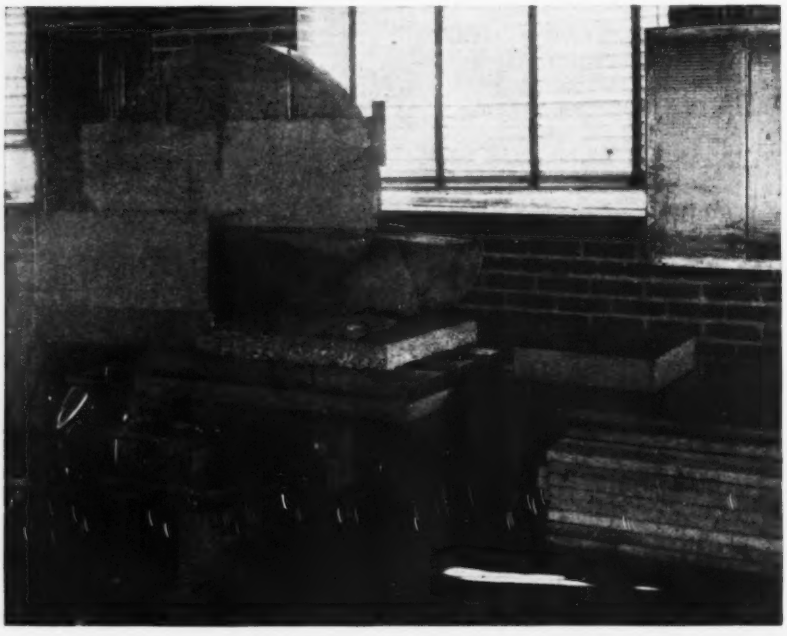
Laboratory Saw

by R. R. LITEHISER

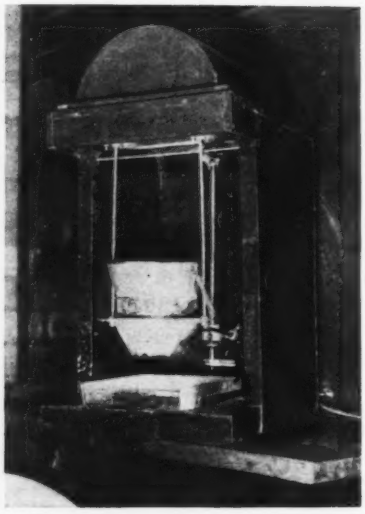
Chief Engineer, Bureau of Tests,
Ohio Department of Highways,
Columbus, Ohio

One of the tasks of highway laboratory workers is to cut large samples of paving material into sizes suitable for tests. In the laboratory of the Ohio highway department they have rigged up the circular saw shown and it has proved its value. The saw is mounted on an old discarded surface-grinding machine. It is driven through a silent chain by a 30 hp. motor. The saw is 26 in. in diameter and consists of a circular steel plate into the rim of which are inserted 30 abrasive plugs.

Being driven off the motor shaft, the table holding the sample to be cut moves under the saw at a constant speed and at the end of its travel automotically stops the motor. Jigs have been made to hold almost any shape of sample to be cut and the saw has been used to cut bituminous concrete, portland-cement concrete, several kinds of stone, brick and asphalt plank.



Laboratory rigged saw cuts all sorts of paving materials into test sizes.



A cement sifter that speeds up the preliminary 20-mesh sieving.

Quick Preliminary Sieving

by H. F. HEDDERICH

Superintendent of Physical Laboratory,
Indiana Highway Commission
Indianapolis, Ind.

In preliminary sieving of cement through the 20-mesh sieve (ASTM, C77-32, Sec. 6) the Indiana highway laboratory has mounted a standard 8 in. diameter test sieve in a ring which is suspended from the top of a cabinet by two ¼-in. rods. These rods are connected to the cabinet by flexible fastenings to permit oscillation of the sieve. Horizontal rods fastened to each side of the ring are connected to the outside of a ball-bearing unit at the back of the cabinet. A shaft through this bearing carries a weight off center, and is fitted with a universal joint between the bearing and the ¼-hp. motor which operates the shaker. When the motor is running, the off-center weight causes a rapid oscillation of the sieve. A 5-lb. sample of cement will pass through the sieve in about 15 sec. and produces little dust.

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Solvent Recovery Still

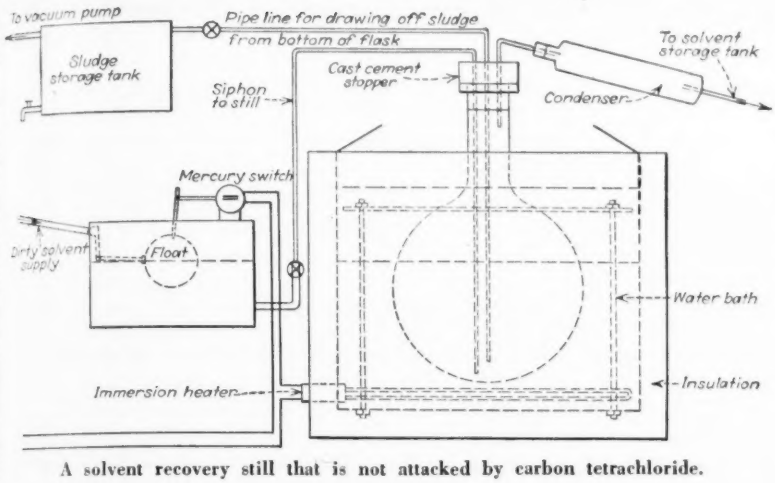
by W. R. LOVERING

Assistant Physical Testing Engineer,
Materials and Research Department,
California Division of Highways,
Sacramento, Calif.

In the laboratory of the California division of highways several different types of solvent have been used to extract bituminous mixtures. Benzol was reasonably satisfactory, but because of fire hazard was replaced by carbon tetrachloride. The large amount of solvent used and the relatively high cost of CCl_4 made it necessary to reclaim the used solvent.

Seeking apparatus to recover the solvent, a commercially manufactured still was purchased. This still is designed to be automatic in operation and was advertised as being suitable for carbon tetrachloride distillation. After a short time, however, the distillate gave indication of a high acid content and was evidently attacking the copper lining of the still. An attempt was made to correct the condition by substituting a pure iron inner container heated by a water bath but this also was attacked by the solvent and produced acid vapors.

Experiments indicated that glass containers could be used without marked deterioration of the solvent, and to retain the semi-automatic continuous flow operation, the design shown in the accompanying sketch was worked out. A constant level of liquid in the flask is maintained by a float chamber and a siphon. Heat



A solvent recovery still that is not attacked by carbon tetrachloride.

is supplied by immersion heaters in a water bath. A mercury switch on the control float shuts off the heat when the supply of solvent becomes exhausted. Stoppers for the distillation flasks are cast from neat cement as cork shrinks when exposed to the solvent vapors and rubber stoppers are out of the question.

As shown above, sludge can be removed from the flasks without disturbing the connections.

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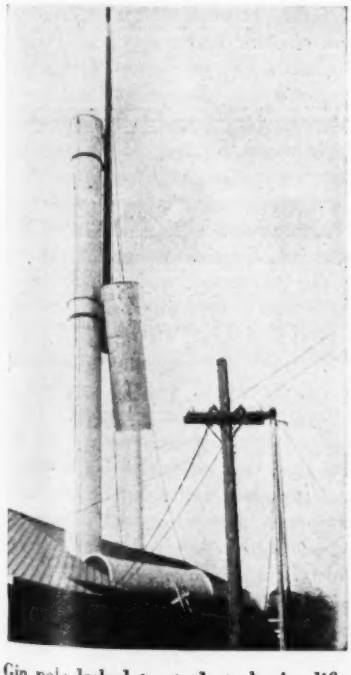
Gin Pole Erects Steel Stack

by RALPH C. TAYLOR
Pueblo, Colo.

A simple and fast method of hoisting and seating successive sections of shell in erecting a steel smoke stack is to use a gin pole mounted as shown by the accompanying illustration. As indicated, the gin pole is lashed by ropes to the part of the stack that has been erected so that its top is high enough to set a new section of shell. As the stack goes up the gin pole is lifted and fastened at a higher elevation. The procedure described was followed by the Weicker Transportation Co., L. M. Rhoades, manager, in the construction of a power house at the state hospital in Pueblo, Colo.



Gin pole lashed to steel stack simplifies erection.

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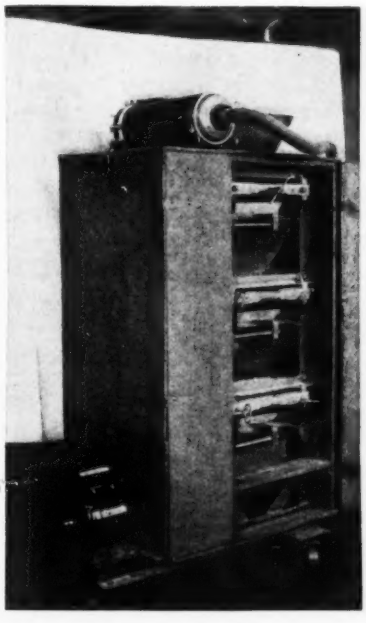
Pulverizing Soil Samples

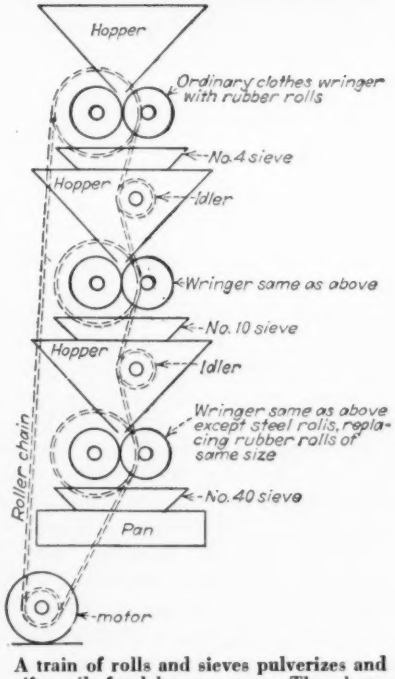
by R. R. LITEHISER
Chief Engineer, Bureau of Tests, Ohio Department of Highways, Columbus, Ohio

A time-saving device for preparing soil samples for test which is used in the Ohio state highway testing laboratory, is shown by the accompanying illustration.

The device consists of a series of three washing-machine-wringer rolls mounted on a frame with a chain drive geared to a ½-hp. motor. A series of gears run by the same motor vibrates sieves placed immediately under each set of wringer rolls. The apparatus is completely enclosed and an attached vacuum sweeper removes the dust made by the pulverizing process. Doors are provided to facilitate any repair which may have to be made and for quick removal of the shaker sieves for weighing purposes.

The rolls are adjustable so that the opening can be varied, and since the upper rolls are made of rubber, the crushing of any great amount of stone is negligible. It has been found that the time of sample preparation can be decreased considerably even though a mortar and pestle is used occasionally to augment the pulverizing of hard plastic clays.





A train of rolls and sieves pulverizes and sifts soils for laboratory tests. The photograph above shows the apparatus.

An Engineering Society Centenary

by A. J. BUHLER

Director, Department of Bridges, Swiss Federal Railways, Bern, Switzerland

Founded in the early industrial period, the Swiss Society of Engineers and Architects continues to occupy a broad engineering field after 100 years of activity

CELEBRATION of the centenary of the Swiss Society of Engineers and Architects on Sept. 4 and 5, 1937, marked an event of unusual character. The society includes all of the technical groups, and thus is a truly comprehensive engineering society rather than representative of a single branch such as civil engineering or mechanical engineering.

From its beginning in 1837 the society has been all inclusive in its scope. Today, from the original group of 57 founders it has grown to a membership of 2,500 — some 970 civil engineers, 260 mechanical engineers, 440 electrical engineers, 80 survey and reclamation engineers, and in addition 670 architects and 80 chemists. Despite this unusual diversity, or possibly because of it, the society has flourished without interruption throughout its century of existence.

Grew up with industry

It is significant to recall that at the time the society was founded industry as we know it today was in its early youth. Not only was the number of engineers quite small but technical colleges were few and remote. Under these conditions the profession was in need of a means of exchange of knowledge and experience. As specialization had not progressed to its present extent, engineers had more problems in common and almost every problem was a subject of joint interest and discussion. It was natural, therefore, that the new society admitted engineers and constructors of every kind, whether occupied with buildings, bridges, roads, or with machines or hydraulic structures.

In the subsequent years the society grew steadily. Its largest progress was made during the 25 years following 1850, when railroad construction began. This, however, led to a large growth in the civil engineering membership of the society, which for a time forced other fields of engineering into the background. After the railroad building period, therefore, the society was organized (1877) with the main purpose of making it more completely representative of Swiss engineering and thereby giving it greater importance in public affairs of technical character.

Functions changed

After the Swiss Federal Polytechnic Institute was organized, in 1856, spread of technical education caused the admission of members to be determined by technical qualification rather than by opinion expressed through votes. This marked an important time of change. By now, technical literature had become available in abundance, and gradually the functions of the society changed. Thenceforward it occupied itself largely with the preparation of standards, the study of water-right legislation, engineering education, question of liability of engineer and the like.

The recent period has seen still further emphasis on professional questions and public affairs, in place of the technical discussion of early days. Especially the past 30 years have been a time of continuous progress in influence on public matters. Membership qualifications have been raised, not only in technical but also in moral and ethical requirements—virtues which it is hoped may also be appreciated in other countries, in which Swiss engineers often are compelled to find their field of work because of the restricted opportunities and overcrowded condition of Switzerland (the country is obliged to import a third of its food supply).

Among recent activities of the society have been the preparation of rules for prize competitions, establishment of fee classifications, specifications for materials and structures of steel and concrete, bidding forms, rules of professional practice and the like. Other activities include an engineering employment service, for which there is great present need, as about 1,000 engineers are unemployed. Of the society's publications the most elaborate is the "Bürgerhaus," a 30-volume work.

Many specialist groups

With this broad field of activity and its diverse membership, the society has developed its form of organization to correspond. The principal current activity is centered in 18 local sections. It also has formed specialist groups, as for mechanical engineers, structural and concrete engineers, etc. Some specialized engineering activities, however, did not remain within the society but became independent, largely because the academic standards of the society were not suited to the group. Thus, from what was at the inception a purely technical body, the Swiss Society of Engineers and Architects has become a sort of holding organization that brings together all college trained engineers, whether in private or in public service, and unites them in a professional group.

Returning to the centenary celebration, it may be appropriate to note that two memorial publications were prepared and published to commemorate the event, an historical record of the hundred years of the society's history, and a memorial volume by the Institute of Technology, both of which give a brief summary of technical development in Switzerland.

THE WEEK'S EVENTS

(Continued from page 287)

Cable and Deck Salvaged From Falls Bridge

Most of the wooden decking, much of the copper cable crossing the bridge, and about 150 tons of steel have been salvaged from the wrecked Falls View Bridge across the Niagara River (*ENR*, Feb. 3, 1938, p. 161) by the Robertson Construction & Engineering Co. of Niagara Falls, Ont. The company holds a contract for the salvage operations from the International Railway Co., owner of the bridge, under which the railway company has transferred all of its rights in the portion of the wreckage lying in Canadian waters to the Robertson company. Engineering advice and opinion has been against any effort to salvage the portion lying in American waters because of the great danger to human life. The Robertson company is doing the work without any supervision or control from the railway company. It is carrying on its work by means of a large crane on the Canadian bank.

The wreckage of the bridge has been broken up by dynamite blasts in an effort to insure that the bridge will sink when the ice goes out rather than form a dam and do possible serious damage. This work was carried out by Jesse L. & Gordon Baugh, Indianapolis contractors.

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Golden Gate Bridge Sways In 75 m.p.h. Wind

A 75 m.p.h. wind at San Francisco afforded an interesting opportunity to observe sway resultant from horizontal load on the 4200-ft. suspension span of the Golden Gate Bridge. Although it was impossible for a person to stand or walk on the bridge without support during the height of the blow, automobiles continued to cross during the storm, sheltered to some extent by the concrete railing which extends 5 ft. 3 in. above pavement level.

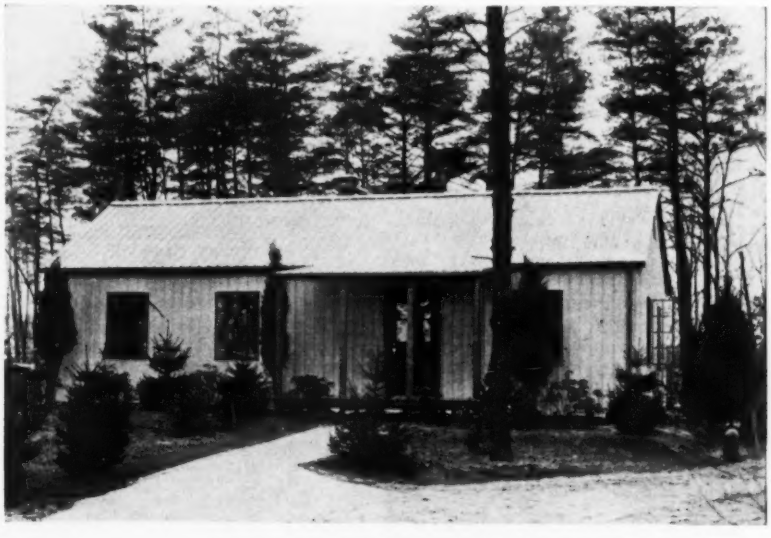
There is no anemometer at the bridge but wind velocity reported by the U. S. Weather Bureau at San Francisco Municipal Airport was 78 m.p.h. At he height of the storm Russell G. Cone, engineer, Golden Gate Bridge and Highway District, went to the south tower and from that point, by observing the horizontal curve of the roadway against the background of the north tower, estimated the horizontal deflection at mid-span to be about 8 ft. Vibration of the suspender cables, he said, was sufficient to cause the two cables of each pair, which are 15 in. apart, to strike against one another. The vibrating cables emitted a low tone that was clearly audible.

A notable phenomenon was the vertical movement of the roadway; the wind caused waves in the floor system, apparently several inches high, to move rapidly across the bridge. The roadway is a concrete slab 60 ft. wide and there are two concrete sidewalks 10 ft. wide. Stress joints in the roadway occur at 50-ft. intervals.

Grand River Project Must Have License

Operation of the proposed $20,000,000 Grand River dam and hydro-electric plant in Oklahoma will affect navigable stages of the Arkansas River, to which the Grand River is tributary, according to a finding of the Federal Power Commission. The commission held Feb. 12 that the Grand River Dam Authority, which is building the project, must obtain a federal license. The commission reached this conclusion at a hearing held Jan. 27 at which representatives of the authority contended the project was not within the commission's jurisdiction.

The Grand River project includes a 147-ft. dam, a 2,000,000-acre-ft. reservoir, and a generating plant with installed capacity of about 80,000 hp. The project is federally financed.



PREFABRICATED FARM BUILDINGS

PREFABRICATED housing moved into the rural areas with the completion Feb. 11 of a sample group of prefabricated steel farm buildings at Greenbelt, resettlement project near Washington. The design of the buildings was worked out jointly by the Farm Security Administration (formerly the Resettlement Administration) and the Tennessee Coal, Iron & Railroad Co. to provide a complete set of farm structures for less than $2,000 plus a small erection cost. The group comprises a five-room house, barns, smokehouse, poultry house and sanitary privy.

All of the buildings were built by bolting together standard panel sections made of galvanized copper-bearing steel sheets welded to standard steel channels and angles. These panels are made up in 4 ft. widths and in various lengths, and by combining them with steel doors, window frames, and roof panels, a building can be erected with dimensions varying to suit requirements.

The buildings are supported on steel posts assembled from standard channels and welded to steel footing plates.

The interior of the house is lined with wallboard. and wood is used for floors, baseboard and other trim. A steel fireplace unit with air-circulating louvres heats the entire house.

Preliminary estimates indicate that a farm building group such as was erected at Greenbelt can be supplied at about the following costs:

	Dimensions	Material	Labor	Total
House	20 x 40 ft.	$1,050	$200	$1,250
Barn	20 x 32	550	130	680
Poultry House	12 x 12	110	14	124
Smoke House	8 x 12	98	12	110
Privy		40	10	50

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

AMERICAN SOCIETY FOR TESTING MATERIALS, regional meeting, March 9, and committee week, Seneca Hotel, Rochester, N. Y., March 7-11.

AMERICAN RAILWAY ENGINEERING ASSOCIATION, annual meeting, Chicago, March 15-17.

BUILDING OFFICIALS CONFERENCE OF AMERICA, annual meeting. Willard Hotel, Washington, March 21-25.

AMERICAN SOCIETY OF CIVIL ENGINEERS, Spring meeting, Jacksonville, Fla., April 20-23.

AMERICAN SHORE & BEACH PRESERVATION ASSOCIATION, annual meeting, Washington, D. C., April 19, and Jacksonville, Fla., April 21.

AMERICAN WATER WORKS ASSOCIATION, annual convention, Roosevelt Hotel, New Orleans, April 24-28.

REGIONAL AND LOCAL

NEW YORK STATE ASSOCIATION OF HIGHWAY ENGINEERS, annual convention, Hotel Martin, Utica, March 3-5.

IOWA ENGINEERING SOCIETY, annual meeting, Iowa City, Mar. 9-10.

NEW JERSEY SEWAGE WORKS ASSOCIATION, annual meeting, Stacy Trent Hotel, Trenton, N. J., Mar. 10-11.

CONNECTICUT SOCIETY OF CIVIL ENGINEERS, annual convention, Hartford, March 15-16.

MICHIGAN SEWAGE WORKS OPERATORS ASSOCIATION, annual conference, Lansing, Mar. 31-April 1.

MICHIGAN ENGINEERING SOCIETY, annual meeting, Grand Rapids, April 7-9.

SECTION MEETINGS, American Water Works Association:
New York. Jamestown, Mar. 17-18.
Louisville, Ky.-Tenn., March 21-23.
Canadian, Windsor, Ont., Mar. 23-25.
Illinois, Decatur, April 5-6.
Indiana, West Lafayette, April 7-8.
Pacific Northwest, Spokane, May 19-21.

ELECTIONS AND ACTIVITIES

D. V. TERRELL was elected president of the Kentucky Society of Professional Engineers at a recent meeting in Lexington. New vice-presidents are Paul M. Jones and W. B. Wendt.

THE NORTH CAROLINA SOCIETY OF ENGINEERS at its annual meeting in Raleigh elected C. W. Mengel president. W. N. Piatt was elected vice-president and Roy L. Williamson secretary-treasurer.

W. B. WALRAVEN was elected president of the Illinois Society of Engineers at its annual meeting in Peoria last month. The new vice-president is M. E. Amstutz, and Harold E. Babbitt was elected secretary-treasurer.

NEW OFFICERS of the Sacramento section of the American Society of Civil Engineers are: president, Norwood Silsbee; second vice-president, Oswald Speir; secretary, Mark S. Edson. Paul S. Jones, second vice president for 1937, automatically becomes first vice president for 1938.

EDWARD G. CANTWELL was elected president of the Ohio Society of Professional Engineers at its annual convention in Columbus early this month. Other officers are: vice-presidents, F. C. Tolles and Nelson J. Bell; treasurer, E. A. Lawrence. The society voted to set up a speakers bureau to supply speakers on engineering subjects. An engineering education section and a municipal engineer section were added to the society at the convention.

C. D. HARRINGTON was elected president of the Canadian Construction Association at its annual convention in Quebec City last month. Other officers are: vice-president, Cecil H. Gunn; secretary, William J. Bavington; treasurer, John Parkin.

THE ENGINEERS CLUB of Vicksburg elected the following officers at its annual meeting Jan. 11: president, William H. Jarvis; vice-president, J. R. Lessel; secretary-treasurer, Edwin H. Stahl.

A BOARD MEETING of the New York State Association of Highway Engineers elected the following officers: president, John F. Jahn; vice-president, T. J. Cobey; secretary-treasurer, Austin M. Sarr.

BERNARD L. CROZIER was elected president of the Maryland Association of Engineers at its annual meeting late last month. Other officers are: vice-presidents, I. C. Root and Frank K. Duncan; secretary, L. W. Kern; treasurer, P. Y. K. Howat.

WILLIAM H. RHODES is the new president of the Louisiana section of the American Society of Civil Engineers, elected last month. Other officers include: vice-presidents, A. J. Negotto and Norman E. Lant; the new secretary-treasurer is J. A. McNiven.

HENRY R. STEVENS has been elected chairman of the recently-formed Seattle chapter of the Washington Society of Professional Engineers. Walter W. Weedin is vice-president; R. R. Ealker, secretary, and William B. McAdam, treasurer.

THE AMERICAN SOCIETY OF PHOTOGRAMMETRY met in Washington Jan. 24-25 and installed the following new officers: president, Virgil Kauffman; vice-presidents, Marshall S. Wright, O. M. Miller; secretary-treasurer, E. S. Massia.

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License Examinations

IOWA: Examination for professional engineering, Mar. 22-23, and for land surveying, Mar. 24, in the Senate Chamber at the State House in Des Moines.

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Capen Receives Award At A.W.W.A. Meeting

At a meeting of the New Jersey Section of the American Water Works Association on Feb. 15 it was announced that Charles H. Capen, Jr., engineer of the North Jersey District Water Supply Commission, had been unanimously selected by the section as the recipient of the George W. Fuller memorial award for 1937. The award, instituted by the A.W.W.A. and presented to one member of each local section, recognizes outstanding contributions to the advancement of waterworks practice. Mr. Capen's contribution, an analysis of water supplies in northern New Jersey, was held to be of particular importance to the clarification of the water policy of the state.

Speakers at the winter meeting of the section included E. J. Cleary, assistant editor of *Engineering News-Record*, who described recent water supply developments in the South, and George D. Norcom, Federal Water Service Co. of New York, who discussed the treatment of underground waters. L. T. Purcell, North Jersey District Water Supply Commission, presented a film on micro-organisms made by J. B. Hawley, of Hawley, Freese & Nichols, consulting engineers, Fort Worth, Texas.

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Moving Picture Will Show Effects of Silicosis

A moving picture showing the harmful effects of silicosis and the methods by which it may be prevented will be released by the U. S. Department of Labor about Feb. 25. The one-reel picture, entitled "The Story of Silicosis," will be accompanied by sound effects and an explanation of what is shown.

After showing the nature of the disease by means of illustrated cross sections of the human body, the film shows various dusty industrial operations and then traces the course of the disease in a typical silicotic.

OBITUARY

ATTILIO F. LIPARI, connected since 1927 with the New York City engineering firm of Fred R. Harris, Inc., died Feb. 13 in New York at the age of 48. A native of Italy, Mr. Lipari graduated from Columbia University in 1913 with the degree of C.E. and served for several years as assistant engineer to the Standard Concrete Steel Co. of New York City. He served in the army as a second lieutenant and engaged in other war service from 1917 to 1920. After about a year as a draftsman for the J. G. White Engineering Corp., he became a structural engineer for C. B. Comstock of New York City, holding that position until 1925 when he became associated with the Chicago firm of A. L. Bobbs. In 1927 he became principal assistant in charge of design for the Harris Co. and at the time of his death was assistant to the head of the firm.

FRANCIS C. MCMATH, retired Detroit civil engineer, died Feb. 13 in Detroit at the age of 71. Mr. McMath was president from 1900 until 1921 of the Canadian Bridge Co. of Windsor, Ont., and during that same period, between 1911 and 1919, he served as consulting engineer for the St. Lawrence Bridge Co., Ltd., in connection with the cantilever bridge across the St. Lawrence River near Quebec.

OSCAR BEAUCHEMIN, who was connected with the engineering department of the City of Holyoke, Mass., died Jan. 8.

HARRY E. SMITH, 64, Indianapolis general contractor, died there recently. From 1901 until 1924 he was general superintendent of building construction for the Bedford Stone & Construction Co. and since that time he has been associated with his son in the Service Construction Co.

MILTON W. THOMPSON, 63, civil engineer for the Thompson & Mosley Dredging Co. of Georgia, Florida, and North Carolina, died in Atlanta, Feb. 10.

LEWIS B. HARRIS, 82, San Diego civil engineer, died there Jan. 27. Mr. Harris was assistant engineer in charge of construction for the Northern Pacific R.R. from 1879 to 1882 and then served for two years as water supply engineer for the Southern Pacific. After brief connections with various Western railroads, he served for two years as chief engineer of the San Diego Flume Co. and then for eight years as chief engineer of the Mt. Tecarte Land & Water Co. Except for several short periods as chief engineer of the Southern California Mountain Water Co., he practiced privately after 1898. He was for a time harbor master for the port of San Diego.

JAMES ANDERSON, civil engineer of Lake Forest, Ill., died Feb. 6 at the age of 68. He was trustee of the North Shore Sanitary District and president of the James Anderson Co., civil engineers, which he founded in 1891. He had served as engineer for many towns in the North Shore area and was county surveyor of Lake County for 1896 to 1912.

EDWARD A. WHEATLEY, registrar and secretary-treasurer of the Association of Professional Engineers of British Columbia, died Feb. 2 in Vancouver at the age of 53. Mr. Wheatley received his engineering training and first practice in England, coming to Canada in 1910. He practiced in Canada until 1914, when he enlisted and served until 1918, rising to the rank of captain. He was appointed to his position with the Association of Professional Engineers in 1921.

GEORGE E. LEIGHTON, retired Boston building contractor and formerly a member of the firm of Woodbury & Leighton, died in Miami, Fla., Feb. 8 at the age of 88. He was connected with construction of the Boston Public Library, the north wing of the Massachusetts State House, the new Old South Church and many other Boston structures.

W. H. ALDERSON, California bridge engineer, died in Oakland, Feb. 5, at the age of 57. After graduation from the University of California in 1904, Mr. Alderson was employed by the Southern Pacific R.R. for several years, and he later spent a year in the bridge department of the O.W.R.&N. Co. at Portland. Later he held positions in designing offices in several railroads in St. Paul and Chicago, where he remained until he returned to the Southern Pacific to work on the Martinez bridge design in 1929. From 1933 to 1937 he was structural designer for the National Park Service in San Francisco and at the time of his death was in the employ of the Southern Pacific on bridge design incidental to the Shasta Dam line change.

WALTER G. MCDONALD, for 35 years supervisor of buildings and bridges for the Burlington Railroad at Lincoln, Nebr., died while on a visit to Denver, Feb. 1.

CARL T. HUMPHREY, dean of the engineering school at Villanova College, died Feb. 7, aged 65. Dr. Humphrey, a graduate of Massachusetts Institute of Technology in 1905, taught there for two years and then became an instructor at Villanova. He was made dean of the engineering school in 1920. He taught mechanics and civil engineering.

RICHARD W. JONES, retired, former chief of the topographical division of the Bureau of Highways of Brooklyn, N. Y., died Feb. 6 in New York City. After attending the Naval Academy for three years, Mr. Jones worked as a construction engineer on several railroads in this country and South America. In 1883 he became resident engineer in charge of construction of the Lexington Ave. elevated railroad in Brooklyn and later was connected with construction of the 2d, 3d, and 9th Ave. elevated lines in Manhattan, and the Atlantic Ave. improvement of the Long Island R.R. in Brooklyn. He joined the engineering staff of the borough of Brooklyn in 1903.

Wide World Photos

EDISON TOWER ILLUMINATED

NIGHT VIEW of the Edison Tower which was dedicated Feb. 11, the 91st anniversary of the birth of Thomas Edison. The tower, 131 ft. high and topped by a 14-ft. replica of Edison's incandescent lamp, marks the site of the laboratory where Edison's first practical lamp was produced, at Menlo Park, N. J.

PERSONAL

PERRY EVANS has been appointed city engineer of Kent, Ohio. Mr. Evans has handled the city engineering work on a part-time basis for some years, but the city has only now decided to have a full-time city engineer.

GEORGE N. SCHOONMAKER, formerly director of public service in Toledo, Ohio, has been appointed to the newly created post of chief engineer of the Toledo Water Department. Mr. Schoonmaker has been in the water department 14 years and has been connected with the Toledo city service for 26 years.

L. H. HUNTLEY has become construction engineer on the Possum Kingdom dam for the Brazos River Conservancy and Reclamation District.

HAROLD J. LOCKWOOD, former chief engineer in charge of WPA projects in Maine, Vermont, and New Hampshire, has been appointed head of the department of electrical engineering at Manhattan College. Professor Lockwood was formerly an instructor at Lafayette College, his alma mater, and he has taught at the Thayer School of Civil Engineering at Dartmouth College. In 1931 he became consulting engineer for the state of New Hampshire.

JOSEPH W. GOLDENBERG and B. O. Cooper have opened offices in East St. Louis, Ill., to practice as consultants in the fields of structural, industrial and municipal engineering. Mr. Goldenberg was formerly contracting engineer with the St. Louis Structural Steel Co., and Mr. Cooper has been office engineer with the East St. Louis Park District since 1931.

MAJOR A. B. JONES, U. S. District Engineer at Duluth, has been transferred, effective Mar. 31, to the office of the chief engineer in Washington.

HENRY E. BEYSTER, for the past 18 years in charge of construction and maintenance for the Fisher Division of General Motors Corp., has been appointed commissioner of public works of Detroit. He succeeds Laurence G. Lenhardt whose appointment as engineer for the water board was announced at the time that George H. Fenkell retired as general manager of that body. Before his connection with General Motors, Mr. Beyster was a superintendent for the firm of Albert Kahn, Inc., and earlier was connected with the firm of Beyster Bros.

E. E. STANSBERRY, civil engineer of Little Rock, Ark., and since 1931 assistant director of the National Reemployment Service at Little Rock, has been appointed assistant chief of the Arkansas State Employment Service. From 1925 to 1931, Mr. Stansberry was city engineer of Little Rock.

COMMDR. CARL A. TREXEL of the Navy Civil Engineer Corps, who has been project manager of the Marine Corps Facilities Section of the Bureau of Yards and Docks, has been assigned to duty as design manager of the bureau at Washington.

A. J. DARWIN has resigned his position as county engineer of Garfield County, Wash.

WALTER J. HIGGINS has been appointed Garfield County engineer with headquarters at Pomeroy, Wash.

R. B. JENNINGS, chief designing engineer of the Columbus, Ohio, engineering department, has resigned after 12 years in the city service to become Columbus representative of The Trane Co.

FREDERICK K. WING, chief engineer of the Niagara Frontier Planning Board since 1935, has been made city engineer of Buffalo, N. Y. The city engineer post has been vacant since W. A. Rathmann resigned five years ago; since that time John T. Mockler, first assistant engineer, has been in charge of the office. Mr. Wing has been practicing in Buffalo, specializing in sanitation, waterworks, sewage and sewage disposal projects, since 1890.

CAPT. CARL A. CARLSON of the Navy Civil Engineers Corps has left the Mare Island, Cal., Navy Yard, where he was public works officer, and now is general inspector and procurement officer for public works in the 11th, 12th and 13th naval districts.

ROY L. WILLIAMSON has been appointed commissioner of public works of the city of Raleigh, N. C., to succeed the late S. J. Ferguson. Mr. Williamson has been in the city service for 12 years as city engineer and director of utilities.

G. G. LANCASTER, resident engineer for the Chesapeake & Ohio R. R. at Huntington, W. Va., has been promoted to special engineer in the office of the chief engineer at Richmond.

W. F. COCHRANE, formerly PWA director for South Dakota and earlier city engineer of Watertown, S. D., has been made manager and superintendent of the municipality owned utilities at Watertown.

H. T. HAZEN, regional chief engineer for the Canadian National Ry. at Moncton, N. B., retired recently. Mr. Hazen has been in railway work since 1889. He was appointed engineer of maintenance of way at Toronto by the C. N. R. in 1917 and three years later became acting chief engineer there. In 1923 he was appointed assistant chief engineer of the central region and a year later was transferred to Montreal as assistant chief engineer of the entire system. He was transferred to Moncton late in 1932.

F. C. CONDON succeeds Mr. Hazen as regional chief engineer at Moncton. Mr. Condon joined the engineering department of the C. N. R. at Moncton in 1893 as a messenger and has served there most of the time since, rising through the ranks of draftsman, divisional engineer, engineer of maintenance of way, principal assistant engineer, and office engineer.

LLOYD MCCORMICK, operations supervisor for WPA at New Castle, Pa., has resigned to take over the duties of supervising engineer for a $1,200,000 building program at Slippery Rock Teachers College in Pennsylvania.

CLAUDE P. OWENS, division engineer for the Missouri highway department at Springfield, has been given a leave of absence to assist in the organization of the maintenance division of the Texas state highway department.

W. H. ROOT, maintenance engineer for the Iowa state highway department, has been given a leave of absence for the same purpose.

LEROY COOPER, associated for more than ten years with the engineering department of the city of Canton, Ohio, has been appointed director of public service there. The directorships of public safety and public service were recently separated after several years in combination.

W. W. MITCHELL, former assistant state highway engineer of Arkansas and later senior engineer examiner for the PWA in that state, has been appointed a member of the Arkansas state highway commission.

O. F. GOETZ, chief engineer of the Tennessee state highway department, who has been with the department since it was created, resigned Jan. 26.

GORDON KELLER, assistant engineer for the Arkansas state highway department, resigned recently to enter private business.

VERNON SCOTT has been appointed assistant engineer for the Arkansas highway department with headquarters at Paragould, to fill the vacancy created by Gordon Keller's resignation.